Pseudorabies Fact-Finding Conference

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C. Y. Stephens Auditorium
Iowa State University
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Sponsored by:

Veterinary Services, APHS, USDA
College of Veterinary Medicine, Iowa State University
National Pork Producers Council
United States Animal Health Association
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Iowa Veterinary Medical Association
American Farm Bureau Federation
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WELCOME

Robert Lounsberry

The Iowa Secretary of Agriculture opened the conference by welcoming everyone to Iowa and inviting their participation in the Fact-Finding Conference on Pseudorabies - a disease of swine and other animals that is rapidly growing in importance.

PURPOSE OF CONFERENCE

F. J. MULHERN

What is the criteria needed to launch an eradication program?

One of the first and most important factors is that those directing a program must have the technical information needed to combat it. This does not have to be 100 percent. For instance, with hog cholera we couldn't answer all the questions on wildlife problems. On the other hand, to the best of our ability, we could not see that we had an obstacle.

Once we have enough technial information that says, "yes, we can eradicate," we must turn to an even more important factor. We have to have the cooperation, support and commitment of the industry. They must be ready to accept to necessary restrictions that an eradition program will place on them.

No disease was ever eradicated with a "business as usual" attitude. The hog cholera program was successful because we didn't stampede, people understood where we were going and why.

Eradication programs are costly to the taxpayer and they place a burden on the industry. Eradication goals are important and should not be started without ample evidence.

So that is the purpose of this conference: To give us the information needed to make a decision on how we can best combat this costly swine disease.

PSEUDORABIES IN THE UNITED STATES

D. P. Gustafson

An article was published in the American Farmer on March 12, 1824, which was concerned with "a singular disease of cattle in Ohio." This had occurred in 1813 near the Ohio river town of Marietta and was dubbed "a mad itch."

This was 89 years before the writings of Dr. Aladar Aujeszky, but it wasn't until 1931 that Dr. R. E. Shope demonstrated that "mad itch" and pseudorabies were identical. From this point on the relationship between the infection in swine and other susceptible animals was clearly accepted. During the decades between 1930 and 1960 the disease was mild in swine almost without exception, just as it was in Europe during the period from about 1930 until about 1950.

Losses among baby pigs ranged from 0 to less than 10 percent. It was indeed rare if weaned pigs suffered more than 5 percent loss. A rare instance of 44 percent loss among suckling pigs was reported in 1942 by J. D. Ray.

In 1962, virulent strains of virus appeared. The first we are aware of occurred on the Ralph Sullivan farm in Carroll County Indiana. We observed abortions in pregnant swine and death losses among mature sows. Since that time virulent strains of virus have been found in many parts of the United States.

Milestones

1. Cultivation of the Virus
   - (a) 1933 - minced rabbit brain and testicle - Traub
   - (b) 1941 - chicken embryos - Morrill and Graham
   - (c) 1954 - cell culture - HeLa cells - Scherer and Syverton
   - (d) 1962 - pig kidney - Purdue University

2. Pathogenesis
   - (a) 1962 - recognition of embryo and fetal death resulting from pseudorabies infection - Purdue
   - (b) 1967 - experimental studies on absorption of embryos and abortion - Purdue
   - (c) 1967 - progress of the virus to the brain following intranasal exposure to pseudorabies - Purdue

3. Nature of the Virus
   - (a) The first suggestion that pseudorabies was a herpesvirus was made by A. B. Sabin in 1934
   - (b) First suggestion of immunological relationship between pseudorabies and B virus - Sabin 1934
   - (c) Sero-relationship between pseudorabies and Marek's by FA but not immunodiffusion noted in 1972

(d) The first studies of the effect of pseudorabies on nucleic acid metabolism and the nuclei of rabbit kidney cells was reported by A. S. Kaplan in 1959. Studies on sequence of synthesis of viral proteins and nucleic acids have continued through the 1960's and 1970's probably most notable in the laboratories of A. S. Kaplan and B. Roigman

4. Antiviral Substances
   (a) 1964 - cyclohexamide
   (b) 1967 - labile carbomyl compounds and cyanate
   (c) 1967 - iododeoxyuridine
   (d) 1971 - dithiothreitol
   (e) 1975 - Ara-AMP Ara-arabinoside monophosphate
   (f) 1976 - phosphono acetic acid

5. Vaccines and Antiserum
   (a) 1964 - antiserum studies at Purdue University

6. Diagnosis
   (a) 1931 - serum neutralization tests and transmission tests in rabbits - Shope
   (b) 1940 - serum neutralization and transmission in chicken embryos - Morrill and Graham
   (c) 1954 - viral recognition in cell cultures through cytopathic effects - Scherer and Syverton
   (d) 1967 - fluorescent antibody applications in diagnostic efforts - Stewart and Carbrey
   (e) 1976 - delayed hypersensitivity-skin test - Smith

7. Some Current Significant Studies
   (a) 1973 - arsenicals increase susceptibility of mice - Gainer
   (b) 1973 - lower ab. titers in rabbits given lead acetate, cadmium chloride, or mercuric chloride - Koller
   (c) 1973 - lowered ab. responses in rabbits fed polychlorinated biphenyls - Koller

AUJESZKY'S DISEASE IN HUNGARY AND OTHER EUROPEAN COUNTRIES

L. Csontos

Aujeszky's disease or pseudorabies is widely distributed in Hungary. Incidence of the disease has been increasing in many Western European countries. Since swine are the main host species of the virus, movement of pigs--particularly of virus carriers--from various sources is responsible for spreading the disease.

In Hungary vaccination with the K strain reduced the losses to the minimum by cutting short every outbreak in one week, or when applied to prevent outbreaks in infected stocks or in those exposed to the infection. However, vaccination so far has failed to eliminate the disease. More importantly, it could not prevent the pigs from becoming virus carriers. Factors playing a role in this failure are irregular vaccinations, adding of susceptible pigs to infected stocks, difficulties in rendering solid immunity to pigs with passive immunity, etc. Therefore, eradication of the disease was decided on in order to establish disease-free large scale breeding enterprises so infected premises could be restocked.

In infected stocks, sows, boars and pigs 2-3 months of age are regularly vaccinated over a 2-year period. Then vaccination of weaners are given up. The litters selected for breeding are kept isolated and checked serologically at the age of 6 months. Gilts and boars from negative litters are removed and reared on isolated plants. Offspring are used to replace infected stocks on an all-out, all-in basis. Although limited in number, SPF pigs from highly valuable parents are also used to replace infected herds.

AUJESZKY'S DISEASE IN DENMARK

Viggo Bitsch

Infection with Aujeszky virus occurs primarily in swine and is occasionally spread to other species such as cattle, dogs and red foxes. When animals other than swine are infected, virus may be excreted, but in no cases has evidence been found of a direct transmission of infection from such animals to others.

Only outbreaks in swine and, in a few cases, in cattle have given heavy economic losses to owners. During recent years, 70 to 100 annual outbreaks have been diagnosed in swine, with an average of two to three affected litters per outbreak. About 12 annual outbreaks are seen in cattle, with a mean of two affected animals per outbreak. In cases of respiratory infection (anterior pruritus), the number is higher, while in most cases with posterior pruritus, only a single animal is infected.

Since 1968, when a rapid increase in the number of outbreaks in swine was observed, a control program--aiming at a partial control of the disease--has been on going. The importance of running "closed herds" has been stressed upon the farmers and elite breeding herds and artifical insemination boar centres were brought under control with regard to the disease. This would enable the common farmers to buy uninfected animals in these herds and to avoid the risk connected with the use of boars from centres for natural service.

An average Danish breeding herd has 20 to 30 sows. After infection of herds of that size or smaller, the infection will usually not be severe and can easily be eradicated. In big herds with more than 100 sows, the infection tends to give heavy losses and recrudescence of the disease is often seen. However, so far, only a few such herds have become infected.

Observations since 1968 have confirmed that with the present pig breeding structure, the infection can easily be kept out of uninfected herds. With the exception of a few outbreaks in cattle, transmission of virus from one herd to another was bought about by contact between animals of the different herds.

Control of infection presupposes application of a reliable serological test. In earlier examinations, a modification of the virus-serum neutralization test with a higher sensitivity than the conventional tests was used, but for the last three years another modification (the P37 test) has been used, and this has proved to be more sensitive and still highly specific.

Employment of live Aujeszky's disease vaccines is considered to be connected with certain risks and has never been allowed.

References

1. V. Bitsch: A study of outbreaks of Aujeszky's disease in cattle. I. Virological and epidemiological findings. II. Further investigations on the routes of infection. III. Selected outbreaks of a certain interest regarding epidemiology. Acta Vet. Scand., 1975, 16, 420-423, 434-448, 449, 455.

2. V. Bitsch & M. Eskildsen: A comparative examination of swine sera for antibody to Aujeszky virus with the conventional and a modified virus-serum neutralizatrion test and a modified direct complement fixation test.

3. V. Bitsch: An investigation into the basic virus-antibody neutralization reaction with special regard to the reaction in the constant-virus/varying-serum neutralization test. Acta Path. Microbiol. Scand., Sect. C Immunol., in press.

PSEUDORABIES IN MEXICO

Michael Bedoya

Reports of pseudorabies in cattle in Mexico were received in 1932 and again in 1945. Since cattle are a dead-end for pseudorabies, the disease was not heard of for many years until an outbreak occurred in 1970. From this point on, a few other reports were received from various places in Mexico.

It was not until 1973 that the first serious outbreak occurred in swine, starting with piglets on a farm near the town of Ixtlahuacan de Los Membrillos which had recently imported breeding stock. Because of variation in symptoms several diseases were suspected. Fortunately a rabbit inoculation test was carried out showing characteristic signs of pseudorabies. Several days later it was reconfirmed by the death of the laboratory watchdog, who had eaten the remains of the piglet carcasses.

Investigations were carried on which found that the disease was spreading to neighboring farms. Quarantines were put on, but not before the disease had killed 3,500 piglets and spread in an area of several kilometers. It is interesting to underline that a large rat populaton was on these farms and when measures were taken against them, they migrated to neighboring farms carrying the disease with them.

The disease died down in 1974, but came back again strong during 1975, when in the towns of Moroleon and Uriargato, a high death rate in piglets was reported after the arrival of a boar from Iowa. Measures were taken to stop the spread of the disease, but by this time it had gotten into the largest pig-raising area in Mexico, infecting 37,00 sows with a death toll of 20,000 piglets. Control measures were poor because farmers were hesitant to report the disease and strictly follow the recommended measures because this meant lower prices and loss of prestige.

In 1976, the area continued suffering from the disease, but losses were lower because of a less susceptible population. This year began with two outbreaks near Mexico City.

In most of the initial outbreaks, circumstantial evidence has shown association with recently imported breeding stock, mostly from the United States.

Control measures in Mexico have been (1) isolation, (2) vaccination, (3) rat control, And (4) slaughter of breeding stock. The vaccine has been prepared in our central laboratory using lactating mice brains inactivated with beta propiolactone.

I would like to suggest that during the conference we should try to agree on a uniform strategy to keep the disease from spreading to the rest of the American continent.

PSEUDORABIES IN CANADA

C. L'Ecuyer

Aujeszky's Disease or Pseudorabies has not been recognized in Canada as a clinical disease.

In recent years a small number of pigs from across the country have been found negative by serological testing carried out for various purposes. Pigs are sporadically submitted with clinical diagnosis of encephalitis and these also have failed to give us any evidence of Aujeszky's disease virus infection, both by serological means and by virus isolation.

We are currently conducting a survey on slaughtered swine from all provinces in order to determine the occurrence, if any, of antibodies to this disease. The survey will basically rely on the virus neutralization test supported, if necessary, by the complement fixation and agar immuno-diffusion precipitation tests.

Import requirements for swine from the U.S.A. have been strengthened to reduce the risk of introducing the disease. Pigs must be covered by a certificate dealing with both the animal and the herd of origin and are subject to quarantine and serological tests. Similar conditions affect imports from other countries.

An outbreak of pseudorabies in Canada would be dealt with as a "reportable disease" and eradication attempted.

REPORT ON DISCUSSIONS MONDAY MORNING

Pointed questions from participants and lively discussion of many issues highlighted two question-and-answer sessions at Monday morning's sessions.

Replying to specific questions, Dr. L. Csontos said in Hungary infected and surrounding herds are vaccinated. He feels vaccinations have helped keep the number of cases of pseudorabies at a comparatively low rate in Hungary. But he acknowledged that once a vaccination program is initiated, total eradication of the disease becomes highly improbable. He does not consider rats a factor in the spread of the disease.

Later Dr. Csontos said he believes infection of cattle and sheep result mainly from transfer through the air. Infected pigs shed the virus up to 14 days. About 3 percent of recovered pigs become carriers and intermittently shed the virus. He said killed vaccine has proved useless. He said when a source of origin is obscure, pigs must be vaccinated before moving to another farm or else must move to a farm that has had infection. There is no evidence of shedding vaccine virus after vaccination with the K strain of pseudorabies virus and sero-negative pigs are not carriers or shedders. Antigens used for skin testing in Hungary were inactivated by heat treatment and these antigens caused a sero-negative herd to become sero-positive.

Answering questions about the pseudorabies situation in Denmark, Dr. Viggo Bitsch described "Elite Breeding Herds" in his country and said losses from pseudorabies in these herds are very small. He said no one in his country has been able to prove that the disease is spread through animal excretions. He said foxes in controlled studies have become infected, but he had no information to report on minks.

The pseudorabies control in Denmark outside elite breeding herds, artificial insemination centres and SPF herds is voluntary.

Live vaccines are not permitted, as it is felt that too many questions with regard to the safety of these vaccines have remained unanswered. In countries in Europe where such vaccines have been employed the clinical appearance of the natural disease seems to have become more severe, and vaccination has not displaced infection with field strains of the virus. Furthermore, common use of vaccination would be a hindrance of serological control.

The neutralization test used (P37,24 test) is used in screening tests with undiluted serum (sera from SPF herds are screened in dilution 1:2). It is felt that a negative result after a quarantine period of 14 days will guarantee an uninfected animal.

Dr. Bitsch agreed with Dr. Csontos that "Once you start vaccinating for pseudorabies, you'll have to do it year after year after year." When he was asked "What pressure can be taken to guarantee an animal coming into a herd is not infected?" Dr. Bitsch said the only sure guarantee is to buy hogs from herds under serologic control that have been tested carefully and preferably retested 10 to 14 days later.

Dr. D. P. Gustafson of Purdue University emphasized that vaccines are available from more than one laboratory. He also pointed out that "We don't have firm evidence that wildlife spreads pseudorabies." He said much more research is needed in this area.

Dr. Michael Bedoya explained that since the last outbreak of pseudorabies in Mexico, feeder pigs that have been exposed cannot be sold at auction or even be moved to another farm.

Dr. Bitsch closed the first panel discussion section on a hopeful note by saying he does not expect pseudorabies to spread in Denmark and that he thinks effective control programs will be established soon.

STATUS OF PSEUDORABIES RESEARCH

George Lambert

Prior to 1974 pseudorabies research received little support in the United States. The sudden increase in pseudorabies recently created a demand for laboratory confirmation of clinically diagnosed cases. The American Association of Veterinary Laboratory Diagnosticians (AAVLD) has made considerable progress toward achieving uniformity in diagnostic testing procedures and interpretations. In cooperation with Veterinary Services Laboratories at Ames, Iowa, guidelines for the tests have been established and reagents have been standardized and furnished.

There is a need for a rapid simple inexpensive test for pseudorabies. An intradermal (skin) test has been developed and is currently being evaluated for use as an adjunct to present testing procedures. Latent or clinically inapparent infections continue to be a problem for diagnosticians. Current research is attempting to determine what factors are involved in the initiation or termination of shedding of virus in asymptomatic swine.

Swine are the major reservoirs of pseudorabies virus on a premises. However, more information is needed on the ability of the virus to survive outside the natural host. Additional research is under way to clarify the role of dogs, cats, rats, and various species of wildlife in the dissemination of pseudorabies virus.

Pseudorabies virus has been shown to be a cause of reproductive problems in swine including abortion, mummified fetuses and stillborn pigs. The greatest losses from pseudorabies are caused by the death of neonatal pigs. Hyperimmune pseudorabies antisera can be effective in reducing death losses in neonatal pigs. Research should be directed toward determining optimal methods of production and use of antiserum.

Studies on antiviral drugs and specific disinfectants should be expanded to determine those which are most economical and effective. The search for an effective, safe and stable pseudorabies vaccine should be continued, based on the concept that "it is better to have and not need than to need and not have."

VACCINE TRIALS

E. P. Bass

Porcine pseudorabies vaccine, modified live virus, porcine cell line origin,* was developed.

The tests performed at the laboratories demonstrated the vaccine is safe and effective in protecting swine against pseudorabies.

The vaccine does not shed from the vaccinated pigs, it does not transmit from vaccinates to unvaccinated contact control pigs.

The vaccine protected 100 percent of vaccinated pigs against virulent challenge.

Following vaccination antibodies are produced which may persist for several months.

The vaccination of all swine over three days of age is recommended. Sows should be vaccinated between breedings. Vaccination consists of a single 1 ml intramuscular injection.

Protection follow up vaccination persist at least six months. Animals held beyond marketing age should be revaccinated.

Field trial was performed on 11 farms. 3000 pigs of various age were vaccinated.

The evaluation confirmed the safety and efficacy.

* Norden Laboratories, Lincoln, Nebraska

FIELD TRIALS OF MODIFIED LIVE VIRUS PSEUDORABIES VACCINE

John Bush

In Carroll County Indiana pig production has become very intensive during the past 15 years. With available farm land selling around $5,000 an acre pig production has been forced into confinement facilities. Few farmers can afford to feed or finish hogs on pasture. They can ill afford to use land to pasture sows. A few still farrow on rough ground in warm weather with usually good results. This explosion in land values and a decline in young people engaging in farming has caused numerous changes in the community. People who for years had raised their own pigs and calves, switched to buying feeder calves and feeder pigs. Pigs were purchased from all over the United States. Emphasis was placed mainly on volume. Feeding floors with 1,000 to 2,000 pigs in one group were not uncommon. Projects with 5,000 pigs were fairly commonplace.

Disease became a major problem with groups of pigs this large. Salmonella, dysentery hog cholera, TGE, parasites, etc., were all commonplace. Death loss in some groups was above 25%. People soon began to realize that pigs had to be grouped into smaller lots, therefore, groups of 50 to 250 animals were tried and death loss dropped rather significantly.

The big problem was still lack of quality. Pigs were still coming in from everywhere. It was not uncommon to see a load of 300 pigs originate from 4 states. I remember one load of 225 pigs that came in from Arkansas that, when traced back, actually came from 69 different farms. It was in one of these smaller loads of feeder pigs from Missouri that I first saw pseudorabies in Carroll County in 1956. It was a combination of the lack of quality pigs and their severe disease problems that gradually forced producers back into farrowing. It was the high land values and the low labor supply that forced those producers into intensive confinement operations.

It was during this period of transition that pseudorabies gradually became a more serious problem. From that early case in 1956 a gradual increase in case numbers occurred, especially in the early 1960's. Up until then we were seeing 5 or 6 cases a year in hogs, sheep, and cattle. Since that time we have been averaging approximately 70-80 cases annually and it is steadily getting worse. Our concentrations of pigs in small areas often predispose to heavy death loss and severe morbidity.

Since those early cases in hogs in the late 1950's and early 1960's this disease has been confirmed in the following species of animals: cattle, sheep, goats, swine, dogs, cats, raccoons, squirrels, skunks, mice, rats, rabbits, ground hogs, and the opossum. We have not yet confirmed the virus in the horse -- it is, however, reported in horses

in Australia. As far as it is known, it does not infect humans. Blood tests on farmers, their hired help, veterinarians, and lab workers associated with Indiana cases have all been negative to date.

The pseudorabies virus is classified by research people as a Herpes Virus. In humans this class of virus is usually found in "fever blisters," "cold sores," and "shingles." Our virus isolation attempts on humans with "fever blisters" and associated with the Indiana outbreaks have all been negative. The blisters and erosions so commonly seen in humans are only occasionally seen in animals. We have found these lesions inside the lips and nose and on the tonsils of pigs and in the vulva of gilts, sows, and heifers. Similar lesions have been seen in and around the muzzle and nose of cattle. As some of you know, "shingles" can itch. This disease in animals shows the itch syndrome. Roughly 5% of pigs with pseudorabies will show the itch syndrome -- roughly 75% of cattle, sheep, and dogs will itch severely. The "little" itch humans suffer is magnified many times in animals. They will often itch to the point of self mutilation. I have seen dogs literally tear 1/2 of their face off or chew a whole leg off. I have seen pigs rub an ear until it is no longer there. I have seen Hereford cows rub their sides with their horns until they puncture their chest cavities. I have seen feeder calves rub their necks on barbed wire until they tear open their throats. I have seen sheep rub on a board fence until they tear out an eye. It is often not a pretty sight. This is how the disease gets its "other" name of "The Mad Itch."

This disease as it is seen in hogs is very variable depending on several situations. Death loss is <u>usually</u> most severe in small pigs under 30 pounds. There are exceptions but this is the usual pattern. The death of breeding and finishing hogs <u>does</u> occur but <u>not</u> usually. The disease in pigs of a few days old can look like a severe case of TGE with vomiting, diarrhea, dehydration, and rapid death. In sows usually the disease is simply an animal not eating for a few days. Basically if you see a TGE-like syndrome in a farrowing operation you had better consider pseudorabies.

One of the biggest problems with pseudorabies in a sow-pig operation is the <u>after effects</u>. The inability of many sows to re-breed, the increased incidence of a post farrowing vaginal discharge (MMA), the increase in stillborn and/or mummified pigs and often a reduction in pig numbers in subsquent farrowing is a real economic loss. We usually tell our people that once they have had an outbreak of pseudorabies it will take 1 to 3 years to get back to a near normal operation. Perhaps the best thing about pseudorabies in hogs is that the pig as an animal has a lot of resistance to this virus. He is a tough

animal and many that show symptoms do recover but usually take longer to finish. Quite often most of these recovered animals do become solidly immune and some of them become carriers and shed the virus in their saliva, nasal discharges, and in some cases in their urine. Blood testing on some selected animals and subsequent virus isolations from tonsils recovered at slaughter indicate that some individual animals may carry the virus for at least 2 years following recovery from the disease. This can be both good and bad. It is bad for the breeder that sells breeding stock - bad because he potentially is selling infected carrier animals. It can be beneficial to the commercial operator. It gives him at least the opportunity to establish an immune herd -- it is painful but is has allowed many producers to remain in the hog business in Carroll County.

Naturally acquired immunity is usually a good strong immunity, and since, at this time, no vaccine is commercially available, there is little else that can be done to salvage a good commercial herd. One problem that we currently are experiencing with these so-called immune herds is that it is getting difficult to bring new boars in without having them die after contact with the breeding sows and gilts. Some producers are nearly willing to pay premiums for boars that are immune, even though they might be carriers of the virus.

We have had some producers sell their herds, clean up, lay idle and come back with SPF breeding stock. We have had two of these new herds become re-infected with pseudorabies. We believe that wildlife vectors such as raccoons could have been the source of re-infection. We have been involved in confinement farrowing units that had new facilities and new breeding stock and have found the virus in mice that had nested under the slats on top of the support piers. We have been involved where we believe that straw used as bedding had been contaminated by infected raccoons sleeping and dying in hay mows. We have seen sows in a 40-sow unit all get sick nearly on the same day. The only common thing to all sows was the feed. We definitely feel that mice, rats, etc., can contaminate feed sources and precipitate infection. We have had instances where feeders had lost all their sheep or cattle with this disease and had sold their extra hay to someone that has not had the disease on his farm and the animals sickened and died after eating the hay. We firmly believe that the pig does not have to have <u>direct</u> contact with the mouse, cat, raccoon, or other pigs to get the infection. He only has to have access to where it has been. Remember that the virus is said to live for 2 months when frozen or for 30 days on boards, etc., at 25° F. Consider, too, that there is always the possibility of transmission from nasal droplets or from contaminated pits by ventilation systems.

This disease in the pig usually is suggestive of a "spinal meningitis" type of infection. Usually a pig is observed to be normal in the AM and in the PM he is seen down on his side making paddling motions with his feet and foaming around the mouth. He is usually dead in less than 24 hours. In the dog the infection is very similar to strychnine poisoning and/or the nervous form of distemper. A dog will usually die within 12 to 24 hours from the time he is first noticed to be sick. In cattle the usual picture is one of acute bloat and/or choke. In all cases the death is extremely agonizing. The animal is in extreme torment. The violent itch syndrome is more apt to be seen if the animal survives longer than 24 hours.

I see no reason to expect our experience with pseudorabies in Indiana to be any different than any other area of the country. You can expect a gradual increase of incidence in a given area and gradual spread to other areas of the state. You should be aware of possible problems with pet owners around small towns. Your pigs will be blamed for infections that kill someone's dog or cat. Some universities are dispensing TV films that warn of the dangers of feeding pork scraps to pets -- they should also warn of the dangers of an animal catching a raccoon or a mouse or a rat. I have seen several "valuable" coon hounds killed with this disease when there has been no history of contact with pigs. In this regard, cattle and sheep do not have to have contact with pigs to become infected.

Antibody titers have not been as great in vaccinated animals as occurs in many of the natural outbreaks. Vaccinated animals withstood challenge with the highly virulent Funkhouser isolate as described by Dr. Bass.

In summary:

1. Pseudorabies is an extremely serious disease of swine and other animals in Carroll and adjacent counties in Indiana.

2. Natural exposure of animals in an infected herd has been helpful but costly.

3. Pseudorabies antiserum can be beneficial in protecting the very young pig.

4. The field trials using the modified pseudorabies vaccine looks most promising.

5. There has been no evidence that the modified live virus spreads by contact to nonvaccinated animals.

6. Vaccinated animals with a certificate of vaccination should be allowed to move intrastate and interstate.

7. Eradication can only be accomplished after the disease has been brought under control by use of such a vaccine.

As will be reported by others, pseudorabies antiserum is of little value unless it carries a very high titer and is administered in the very first hours after birth.

I was very elated to be asked to participate in field trials using the modified live virus vaccine (Norden). At the same time I was afraid that the vaccine would be of little or no value in protection of animals.

Presently over 3600 animals have been put on test in Carroll or adjacent counties during the past three months. Of these, more than 2500 animals of various ages have been vaccinated while the remainder have been left as controls.

To date, the vaccine has proven to be safe and effective. In acute outbreaks, death losses have stopped in the vaccinated animals while continuing in nonvaccinates. There has been no evidence of spread of the virus when vaccinated and nonvaccinated animals are held in the same pens.

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RESEARCH AND VACCINES

(Questions, Answers, and Discussion)

A modified live virus pseudorabies vaccine* was developed for use in immunization of swine. The pseudorabies virus known as Bucharest isolate was passaged in a porcine cell line.

Following are findings from closely monitored laboratory tests:

A one ml dose of vaccine was given intramuscularly to each animal.

The challenge virus was the Funkhouser isolate from Carroll county Indiana. It is highly pathogenic and fatal to a high percent of the animals. It was administered by the intranasal route.

Control animals were kept in constant contact with vaccinated animals.

There was 100 percent protection in all vaccinated animals challenged.

The vaccine was safe to use in caesarian-derived, colostrium-deprived pigs.

Pigs maternal antibodies usually prevented a lesser active antibody but it protected against challenge virus.

Antibodies were detected by SN tests in seven days post vaccination and continued to increase for approximately three weeks.

Animals that had been vaccinated, and their pen control mates, at one week of age, were challenged at market weight. All vaccinated animals remained free of clinical signs while all of the control animals sickened. Five of eight animals died.

Challenge virus could be isolated from tonsil swabs for four days from vaccinated animals. Control swine shed the challenge virus until death or from recovered animals for 14 days post challenge.

The vaccine virus could not be recovered from tonsils or nasal swabs or from blood from the vaccinated animals. None of the control animals showed clinical signs. There was no sero-conversion for antibodies in the control animals.

There was transfer of maternal antibodies to offspring that was equal to or higher than that of vaccinated dam.

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*Norden Laboratories, Lincoln, Nebraska

Field Trials

Field trials were performed on many farms in Nebraska and Indiana. These production units were under various levels of management.

In early stages of an outbreak (1) the disease was stopped by vaccinating newborn pigs, but unvaccinated control pigs continued to die, (2) in exposed animals in the gestation units--given time to produce an active antibody--the dams gave birth and mothered good, live pigs, and (3) in finishing facilities, vaccinates had no clincial signs while controls would go off feed, had fevers, with some deaths.

On non-infected farms, two-thirds of all animals were vaccinated and one-third of the herds were left as controls.

There were no clinical signs of sickness in any of the animals.

There were no demonstratable antibodies in any of the animals prior to vaccination. Three week post-vaccination, all of the vaccinated carried an antibody titer. None of the controls had antibodies.

Most questions following the second panel were directed to Dr. E. P. Bass of Norden Laboratories. He said the vaccine from Norden is avirulent, and he described the steps his company took to insure the accuracy and validity of its project.

Other speakers discussed the fact that in some cases exposed dogs and cats succumb to pseudorabies, while in other cases, they are not affected. Dr. John Bush said he actually has seen dogs and cats eating portions of carcasses of hogs that died of pseudorabies without themselves suffering any ill results.

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This is to state that I am a co-operator in the field trials vaccination program for pseudorabies in swine. I am happy to co-operate in this program, having a herd with pseudorabies history. I hope this is an approach to a remedy for this disease.

Dr. John A. Bush vaccinated my group of small pigs February 22, 1977, having had no ill effects from this vaccination program, I think we are working in the right direction.

We, as pork producers, definitely need some help with this problem disease.

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In February, we had a severe case of Aujeszky's in a group of feeder pigs weighing about forty or fifty pounds. Dr. Bush treated five of the six pens of pigs and left one pen untreated. We had no further losses in the treated pigs, and lost several pigs in the control group. The treated pigs have continued to do well with no further death loss.

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Our herd is only one of many that has gone through the scourge of Aujeszky's disease in our community. Due to the fact that researchers and some of the best minds in the country have studied our herd, we perhaps have something to add in how to work with the disease.

During the late winter of 1973, there were some feeder pigs that had pseudorabies and those pigs were less than a mile from an open barn where approximately 100 gilts and young sows were housed. A flock of sheep died from pseudorabies and in no time our gilts were off feed. There was no evidence of disease in the gilt herd at that time but when the gilts and sows started farrowing, we soon found that we had a problem. We lost nearly all of the January farrowing, about half of the February farrowing, and some loss in March 1974. Many pigs were born weak and died. There were many "mummy" pigs and the sows did not milk. Some of the sows became constipated, would not eat, and a few of them died.

After March we again started to save more pigs but the disease started spreading through the slatted-floor nursery and finishing buildings. Many of the pigs that we saved were carrying pseudorabies and in moving the pigs, we also moved the virus to all of the pens in our buildings. We had very little death loss in pigs over thirty pounds but the pigs that did get sick went off feed and they were delayed going to market by about three weeks.

As soon as we found that we had a serious problem we took dead pigs to Purdue. Our veterinarian had already diagnosed pseudorabies but we wanted to find out more about the disease. State and Federal veterinarians were interested in studying a known outbreak of pseudorabies, so we embarked on a blood testing program of all of our sows and gilts as well as some of the fat hogs and shotes. We had around 280 sows and gilts and soon found that all had a pseudorabies antibody titer. The fat hogs and the shotes did not have antibodies at 100 percent but there was a high percentile. It was interesting that nasal swabs did not have live pseudorabies but when a sow was killed at a local plant, live virus was found in a tonsil tissue.

We have now lived through three years of farrowing pigs since the inital outbreak of pseudorabies. In January and February of 1973, we again lost quite a few pigs but it was less than half of the pigs that we lost in 1974. In 1976 we lost very few pigs to pseudorabies but in January

and February of 1976 our losses were more than normal because of the stress of weather. From what I have read and been told, a sow carrying pseudorabies may be affected more by the disease under stress than a sow that is not carrying the disease.

We feel that if we are to raise pigs in our area or in any area where there is any pseudorabies, we must not depopulate. We want to take advantage of the immunity of sows that have gone through the disease. This has worked for us as we have been able to raise about 75 percent of the pigs that we normally should. Those producers who have depopulated have sometimes had to repopulate more than once due to the disease hitting the new herd. We have had to sell a lot of our sows that had "mummy" pigs because the sows do not settle well after farrowing dead pigs. We are not alone in operating in this manner as many of the sow herd in the area have had pseudorabies and not been depopulated.

The only hope that the swine industry has in coping with pseudorabies or eradicating it in the future is the development of an attenuated vaccine for pseudorabies. In the writer's opinion, the only reason the hog cholera program worked was the fact that an excellent attenuated vaccine was in use for several years. It is even more important that a vaccine be developed for pseudorabies in swine because of the many vectors involved. Purdue researchers found pseudorabies in trapped wildlife here.

It might also be added that a pseudorabies eradication program at present, without vaccination, would not be successful. Not only is the cost prohibitive, but the producers who have gone through hog cholera eradication programs so many times are not emotionally ready for it. There is also the fact that as long as there is not a way to keep feeder pigs from carrying in pseudorabies and infecting the wildlife as has been done in our area, there is no hope without a vaccine. Where is there an official who will stop the importation of feeder pigs?

VIEWS FROM PRODUCERS

Keith E. Myers

I am not a producer of feeder pigs; my main business is marketing of feeder pigs. We buy pigs from feeder pig producers and sell them to feeder pig finishers and also have a small feeder pig auction. In addition, we also farm and raise purchased feeder pigs to market weight.

According to the best estimates, one out of every three pigs farrowed goes to slaughter from a farm different than the one on which it was born. In contrast to 20 to 25 years ago, today's feeder pigs are being produced by specialists. Years ago many pigs were sold because either the producer was in financial trouble or the pig was in such condition that it was decided--sometimes with the advice of the veterinarian--to let someone else have the trouble.

Today, most producers know when they turn the boar in with the sows that the offspring are to be sold as feeder pigs. Likewise, there are specialists in the feeding of these pigs that are entirely dependent upon a supply of feeder pigs.

Those in marketing have developed such specialized marketing functions as special feeder pig auctions, the graded sale in which pigs of similar weight and grade are put together for sale, the marketing of pigs by telephone, etc. Selling by weight, the castration of the pigs, the docking of tails, vaccination for erysipelas, identification and other desirable practices have become generally accepted.

Now, I would like to make a few comments regarding the economic impact of pseudorabies on the feeder pig segment of the swine industry. I am not satisfied with the information I was able to put together on pseudorabies. For the most part, no one has kept accurate information as to the involvement of feeder pigs with pseudorabies. I contacted 14 State Veterinarians in the states of South Dakota, Minnesota, Wisconsin, Michigan, Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, Missouri, Tennessee and Kentucky for information on pseudorabies. The number of cases by states was readily available. They reported 474 cases so far this year. A breakdown as to the number in which feeder pigs were involved was not so readily available, and few were willing to say that where feeder pigs were involved they were fully responsible for bringing in the disease.

I also contacted the membership of the National Feeder Pig Dealers Association. While not large in numbers, they are involved in the marketing of a high percentage of the total feeder pigs moved. I contacted others in marketing.

If we take a look at the finishing-end of the business, in other words, from the time that feeder pigs are sold on to market, I could almost say that pseudorabies has not been of economic significance. One of my questions of those in marketing had to do with the number of complaints they had received from their customers on pseudorabies. This may be a better indication than some of you may think, for, believe me, our customers are not bashful when it comes to registering complaints about everything else, such as rhinitis, bloody scours, worms, mycoplasma, mange, belly ruptures and what have you so it's hard to believe that they wouldn't complain about pseudorabies if they had the problem.

There was only one single customer complaint reported. This involved mad itch in some cattle. The hogs had been on the premises three months at the time of the discovery of the mad itch in the cattle.

One of the members of our association, a veterinarian who lives in Carroll County, Indiana, reported that, while he had never received a complaint from his feeder pig customers, he had observed cases of pseudorabies in feeder pigs throughout his year in practice in that area. He was the only one that I was able to find that could furnish me with information of the disease being manifest to the extent that it had become a problem in finishing units. He reported death losses were negligible, the biggest loss being in lack of gains.

After he had told me what to look for, and this was confirmed by several others I talked to, I'm convinced that it's entirely possible that it would be easy to confuse pseudorabies with other disease problems. I believe it is entirely possible that there is, perhaps, more pseudorabies in feeder pigs than has been reported.

Whether this is true or not, I do not know. All I can say now is that to date it hasn't been recognized as a significant problem.

As people in marketing, we are sensitive to the problems of our customers. If something is not a problem to our customers, it really doesn't become too much of a problem to us.

This may account for what I'm sure has appeared to be a lack of concern of those in marketing and of the finishers to the disease, and for the concern toward some of the proposals that have been made for the control and/or eradication of the disease.

I mentioned that within our membership we have a number of cooperatives. These cooperatives have members who produce feeder pigs under contractual arrangements. The four largest in the midwest (and this is as far as I looked) have not received a report of pseudorabies in the herds of their producers. The State Veterinarians of Wisconsin, Minnesota, Tennessee, Kentucky and Missouri, which are major feeder pig exporting states, reported a total of 24 cases in their states so far this year. Tennessee and Kentucky reported no cases.

If we assume that one out of three pigs are is marketed as a feeder pig, then we could assume that one out of three of the problems with pseudorabies involves feeder pigs. I personally feel that this is too high, for many feeder pig producers are relatively small in size, and purely from observation the problem seems to be more in the larger, more highly confined operations. This, too, may be something on which more information in required.

Pseudorabies has been a problem to some feeder pig producers. How much of a problem, I do not know.

We are concerned about pseudorabies. I guess our biggest question at this time is what should we do. I made the mistake of asking for advice on what to do. There were those who told me to get behind an eradication program; others told me that eradication is impossible, that a control program is the best we can expect; others said forget it. Some have told me that vaccination is the only answer. Others have said to oppose vaccination at all costs. Some say that we need more answers, and others tell me we have all the answers we need. I have friends whose opinions I respect on each side.

Frankly, I don't believe that those in the finishing and marketing end of the industry know at this time what our role should be or what we should do.

We believe that, from what we've seen so far, that from the time the pig is sold as a feeder pig on to slaughter that pseudorabies has been of little economic significance. Perhaps the greatest concern is with the possibility of spreading the disease. In this regard, while most feeder pigs go to slaughter and, under today's housing and management practices, do not come in direct contact with other swine, there is some merit to imposing a quarantine-to-slaughter on feeder pigs.

Likewise, we believe there is merit of the reporting and quarantining of cases of pseudorabies.

Other than this, the observance of those things that we know should be done to prevent the introduction and spread of any disease offers the best protection.

Such things as isolating newly acquired animals for at least 30 days, keeping people and vehicles out of our lots, not buying feeder pigs if you have a farrowing operation, and clean and disinfected trucks are just as good a control measure on pseudorabies as any other disease.

We do not question the value of blood testing as a diagnostic tool, or of the value a good vaccine could be in preventing disease. The compulsory requiring of the blood testing or of vaccination of feeder pigs is something else, and I will predict a cool reception to the compulsory use of either by the finishers of feeder pigs or of those who market them with no more of a problem than pseudorabies has been to these two groups to date.

We have heard talk of embargoes. We have seen the economic havoc that embargoes can cause. If you think otherwise, visit with those from Tennessee who, not too many years ago, were embargoed because of hog cholera.

VIEWS FROM PRODUCERS

Denny Shoup

Brief history of our operation: purebred business, 11 years, 250 purebred sows on one farm, confinement in rather condensed area except for most of sow herd and herdsires. In 1977 we sold 500 boars and approximately 100 gilts through 6 production sales and at private treaty. I have specialized in the seedstock business and do not grow any crops or have any other income other than the hog operation.

Case history in our contact with pseudorabies:

On December 15 and 16, 1976, we tested 287 herdboars and sows in the breeding herd as well as some 25 boars and gilts from April, May, and June boar and gilts from December sale and potential Conference entries. Results - completely negative.

January 18, 1977 we observed some rather suspicious symptoms in a group of second litter sows. Respiratory problems nasal discharge, etc., (no abortions at this time).

We began farrowing a group of 85 sows January 20. At the onset, no problems concerning pigs at birth.

January 25 we began observing pseudorabies in baby pigs. During the next three weeks we lost about 800 baby pigs, 25, 50 to 200 pound hogs and 12 sows. Also had about 20 sows abort litters. Losses were complicated by the extremely adverse weather conditions during the corresponding 3 weeks. Source of infection is still a mystery. Most logical is vectors: (1) birds (starlings), (2) wildlife, (3) contaminated straw. This puzzle is a key point in studying this complicated problem. I feel somewhat a victim of circumstances or random selection process. I am sure that we did not make any mistakes in management of our operation. Most of the producers who have pseudorabies in our country are managing their swine operation at extremely high levels.

The losses incurred during the stage of clinical symptoms is not by any means the total economic impact on our operation. During February and March we marketed for slaughter about 150 boars and 150 gilts. A comparison of gross sales for January, February, March, 1976 and 1977 - 1976 = $119,102 and 1977 = $31,710. One purebred breeder in Indiana has reported a decrease of his net worth of $109,000.

As we consider this extremely complicated problem, we reach this conclusion: The purebred seed stock supply is vulnerable, not only in terms of economic impact upon the actual breeders involved, but also impact upon genetic material available in the industry.

ECONOMIC IMPACT ON SWINE INDUSTRY

James A. Meyer

There are four areas that I would like to cover in my presentation.

1. A brief description of our farm operation.
2. The effect of pseudorabies on our pork system.
3. My views of the economic and social impact on pseudorabies on the swine industry.
4. My views on the program needed to cope with pseudorabies.

1. My wife, Madeline, sons Kent, 16, and Jay 14, and I farm 465 acres in northwest Iowa. The land is used to produce corn for our 200-head fed-cattle program and 1300-head farrow-finish pork program. I sell hybrid seed corn along with the farming. We employ one full time assistant when qualified men are available.

The pork system is a continuous-farrow, continuous-sell program. The production flow is designed to farrow four sows each week. All production is on concrete and partial slats except breeding and gestation. Plans are to put the sows on slats this summer. We use three boars of each of two breeds which gives us an option when sows are moved from farrowing house to be bred immediately after weaning. Pigs are weaned at four weeks. A pregnancy tester is used at 7- to 10-day intervals to keep the sow numbers with the boars to a minimum.

The farrowing house is equipped with 20 farrowing stalls. A barn cleaner is used under 22-inch slats at the rear of stalls and the manure is moved to a pit at one end of the building daily. The stalls are scraped daily. Waste feed and pig excretia is moved to center aisle, swept up and mixed one-third sweeping, two-thirds lactation ration and fed to sows up to four weeks prior to farrowing. This inoculation system along with continuous farrowing has been planned to develop immunity as quickly as possible in the face of disease outbreak. Our yearly average litter size has increased almost three pigs per sow in herd per year since this system was initiated.

Each phase of the system is in separate buildings, making it necessary to drive or haul pigs from farrowing to nursery to grower to finishing units.

Hogs are sold weekly on grade and yield system.

The severe cold weather this past winter subjected the gestating sows to extreme stress. Very little bedding is used in portable non-insulated houses with spring loaded doors. We have been successful with chill factors above 0° F, but the persistant subzero weather in January and February proved to be almost more than we could handle. Several sows had to be slaughtered because of prolapse problems.

2. About February 1, I noticed a dead muskrat in one of the gestation lots. On February 15, one of the boars was treated for flu and pneumonia. He was having trouble breathing, was listless and running at the nose. Also at this time we were losing pigs from three of four sows that farrowed in the boys' portable building. On February 20, our dog became sick and died within

24 hours. Two days later, I brought the dog's head, two dead pigs, and two sick pigs to the ISU Diagnostic Lab for test for pseudorabies. We received verification of a positive test on February 23.

Three of the four sows in the boys' farrowing house weaned one pig each. The other sow weaned 11 good pigs. During the third week of February, two sows in my farrowing house lost their pigs. Two other weaned five and eight pigs in March. We have had two sows abort; one sow apparantly reabsorbed her pigs at near full time. She was put in the farrowing house when milk appeared. Two weeks later she had not farrowed and her udder dried up. I turned her out with the boar last week.

Since the first heavy losses we have farrowed 19 litters. Two aborted, one readsorbed and failed to deliver, five lost their pigs, two farrowed litters with two pigs each off in their rear legs, and nine sows have farrowed apparently normal health litters. We lost one boar, two nursery pigs and about 75 suckling pigs. During this same six-week period, about 550 other hogs on the farm seemed to be normal. Two litters farrowed March 30-31 have been losing one pig per day for first three days. Some of the pigs are very weak and lack desire and ability to nurse.

3. In visiting with other producers and veterinarians, it is obvious that my losses have not been as great as some. I feel a continoous farrowing program might have some advantage in developing immunity to pseudorabies as compared to farrowing in groups. There seem to be hot cases where almost all pigs born die and other cases when no clinical signs appear, but yet the herd is positive. My losses to date have been less than $2500, but some cases have been documented with losses up to $30,000. Some counties in northwest Iowa must have 50 percent of producers with pseudorabies. A county with 700 producers could easily have losses totaling over $1 million. A 10-percent incidence in Iowa alone would rob producers in excess of $20 million. Iowa represents 25 percent of hog in the United States. With a similar 10 percent incidence nationwide, losses would be $80 to $100 million. Pseudorabies is a very serious economic problem of the pork industry.

The present economic loss is only part of the problem. Some unanswered questions persist. Now, how long will it last? If herds develop immunity will producers have to go through this every two or three years? The spread of pseudorabies to neighboring farms will always be possible as long as positive animals are around. It appears that pets and other livestock, especially cattle, will always be susceptible as long as the swine herd is positive. We are undergoing this stress now. Can we use the same tractor to feed cattle that has been in the sow lots? Should we change clothes between doing hog and cattle chores? What happens if the cattle or hogs should happen to get out and get next to each other?

Pseudrabies is very much a social problem as well. Those of us who have the virus find that our normal relationship with neighbors is strained. We can't blame them for their cautious attitude. Exchange of help is eliminated. Equipment owned in partnership has to be cleaned and disinfected if possible. And, of course, those producers who produce purebred stock or feeder pigs have lost at least part of their market.

Those producers who have not yet contacted the virus take a nervous peek in their farrowing house each morning to see if it has hit yet.

The seriousness of pseudorabies along with poor crops in 1976 and losses in the cattle business for two or three years has placed tremendous mental strain on pork producers.

4. I am confident pseudorabies can be controlled and eventually eradicated if those of us involved work together. Some significant steps have been taken. The resolution agreed to by the delegates of the recent American Pork Congress in Des Moines should be considered very seriously. The main points in the resolution as I see it are as follows:

a. The control of the movement of infected pigs--both breeding and feeder pigs. The pig seems to be the cause of spread from one locality to another. Blood tests and quarantines should be used.

b. The SN test seems to be a good test, but all labs have to perform the test the same way and read the results uniformly. Producers are not confident of this test because of varying results.

c. Serum may be needed in hot spots to slow things down. A supply needs to be established and then properly administered.

d. A good on-the-farm test is desperately needed, especially for breeding stock and feeder pig producers. The perfection of a skin test should be pursued vigorously.

e. More research work is needed. Some states including Iowa have made tremendous progress in a short time in learning more about pseudorabies. The work needs to continue. Some people feel enough is known to eradicate the disease. This may be true; however, there are still too many unanswered questions about the on-farm and between-farm behavior of the virus.

f. The NPPC resolution calls for funds allocated in the 1978 budget of USDA. With the rapidity of the spread of pseudorabies since August of 1976, we just cannot afford to delay longer on finding answers. Funds in the 1978 USDA budget will not provide help fast enough. I feel we need emergency funds for testing and research immediately. However, I am opposed to using emergency funds at this time to eliminate all positive herds.

Vaccines have been suggested as a way to live with pseudorabies. I understand there are people here from countries where a vaccination program is being used. Their comments about effectiveness will be of great interest to U.S. producers. A projected cost of $4 for each litter farrowed for vaccine, plus administering, would mean an annual expenditure of over $1,000 in my operation. This yearly expense might be better spent for a good control program with eventual eradication of thd disease.

I am hopeful that the best input from researchers, veterinarians, producers, and interested people can be used to generate an effective control program with an end goal of eradication of pseudorabies.

VIEWS FROM PRODUCERS

Vernon Pilger

Without a clinical sign and without a death loss, a herd can become positive herd. Pseudorabies can progress to extreme severity and extreme death loss. This difference in degree must be recognized.

With the knowledge acquired from a severe case of pseudorabies, our approach to a severe--and first-time-incident in a herd would be as follows: Infect all the herd. It is our contention you can live with pseudorabies by having a positive test. It is important every animal be heavily exposed.

By the method described you cut the time required in which pseudorabies goes through the herd. During the eight weeks of living with this disease our losses were not great until the time factor allowed the secondary infections and the pseudorabies to progress. The progress went into the growing finishing units and into the breeding herd animals. Then the losses became great.

If we had exposed the animals immediately, we feel our losses would have been cut by a large number. We had more losses from secondary infections than from pseudorabies itself.

The severity grew with the extension of time and the continuing exposure. Pneumonia was a problem at this stage. We vaccinated for these secondary infections. Our procedure was vaccinating every 24 hours for several days. Many hogs were saved.

In a severe outbreak it is possible for the losses to include 100 percent of farrowings. The losses include all breeding through the farrowing to 4 weeks of age.

This is the least cost loss since you have less invested at this stage. Count this loss off. Get your herd back to breeding condition. Here again one must work with secondary infections. It is a good thing to use antibiotics in feed. Keep close health checks on the herd and vaccinate when necessary.

One important rule to always remember is to maintain good health as you approach the rebreeding. Failure to keep the herd in good health will result in non-breeders. We found the ones that farrow or slough close to farrowing time breed back more readily. The ones which absorbed had a problem rebreeding.

Other tools that should be used in the fight against pseudorabies should be considered. Keep a total positive herd. We test 40 or more animals of all ages. These tests are made monthly. Some animals are tested continually. Others are tested at random. If we have a negative animal that has been raised on the farm, we sell the negative animal. There is no exception. We are very interested in our test to be positive.

Now, is a positive animal a carrier? Our second question: Is a negative exposed animal a carrier?

On February 7, we broke with pseudorabies. Eight weeks later on April 7 we purchased boars that were negative. These boars were exposed heavily. They were supposed to be very sick in four days. They did not become sick. In February 1976, pseudorabies was in the area again. They did test positive but never showed any clinical signs of illness.

Now if a positive herd is a carrier, explain? During the same year we purchased boars all with negative tests. Some became positive in that same February test. However, some remained negative. These have remained negative to this time.

We contend if every animal on the farm had not been severely exposed and built a titer--which is the same as vaccination--the animal is not a carrier.

Is a carrier an animal that has been exposed lightly and not built a titer or has a very light titer?

To vaccinate can be done two ways; (1) Actual vaccination and (2) expose the animal to building its own titer.

On the other side, how does the new farrowing become positive on our farm? This now causes some concern. Can you say a positive animal is a carrier or that it cannot be sold to another herd for breeding when the herd is already positive? If this is the case, can you ship feeder pigs, even from a negative herd, by a test of 10 percent? I contend a 10 percent negative test in a herd could still have carriers. Another item to really consider is that a 40-pound feeder pig can be negative from these herds and later become positive. Therefore, these animals would spread the disease, thus nulifying the controlled movement of breeding stock.

If you eradicate a positive herd now, one year later you will have to eradicate it again. Ten percent testing means very little in controlling the disease through movement.

Why are we wanting to put these controls on pseudorabies and nothing on Smeddi? We live with Smeddi and pseudorabies is in the same virus field.

Those who represent our industry in farming programs and make regulations with which we will live should consider all the segments of our industry. Considerations should be due those who are positive not just the ones who are negative. How much damage would be done by boxing in a segment of our industry by a regulation so severe which actually serves no purpose for the control of pseudorabies?

Pseudorabies will not be stopped by stopping movement of breeding stock. A reason for this is to consider wild life is as much of a carrier that it is. If you stop breeding stock--stop all--or none. This cannot be done.

VIEWS FROM PRODUCERS

Al Marley

First let me thank you for the privilege of telling you a little about my swine operation.

We have about 110 sows in a commercial farrow to finish operation near Russiaville, Indiana. Russiaville is forty miles north of Indianapolis and thirty miles east of Lafayette.

We keep our sows in two old converted dairy barns. Our gilts are in 10-by-24 houses with slotted floors in front. Breeding is done in the houses and barns.

Our main swine building is 200 feet by 40 feet. It has 32 crates, a nursery for 320 pigs and finishing unit for 640 head. The farrowing unit has four-inch concrete slats, and the nursery and finishing unit has six-inch slats over a six-foot pit.

The house is well insulated and has a drop door negative pressure ventilation system.

Our hogs are marketed about one load per week, at local markets or at Wilsons on carcass merit basis.

Now to my purpose for being here. Between Christmas and New Year the kids were home. I found a 60 pound pig in my finishing unit down on his side, paddling with his feet. I got the pig out of the pen and put it by itself. The next morning it was dead. I went to the finishing unit and another pig was showing the same signs. I called Al Zukunf, area extension agent, and asked him to send me the memos on Pseudorabies.

My son-in-law came out the next day, he is a D.V.M., so I described the pigs' actions and asked him what we had. He first thought it sounded like salt poisoning. He took the pig to Purdue, where he works in the Animal Disease Diagnostic Laboratory while getting his Ph. D. in pathology. He called back to give me the good news, that I had Pseudorabies.

About January 3, a herd of 30 sows was to start farrowing. They started January 4. To make a long story short, these sows had about 11 pigs farrowed alive except three, which had all dead pigs. From these 300 pigs we weaned 36 and moved about 30 from the nursery to the finishing house. These pigs are doing poorly.

We lost two sows and about 20 pigs from the nursery and finishing pins. We also lost two gilts in the replacement gilt house.

On Feburary 12, we started vaccinating our February farrowing with Norden's Pseudorabies vaccine. With help from my daughter, Judy, a junior in the veterinary school at Purdue, her husband, Bill, Ralph, Jon and Brenda, we

vaccinated two-thirds of the pigs and left one-third as control. Blood samples were taken from about 10 percent of the pigs, both control and vaccinates.

To the present we have vaccinated 102 pigs and have 52 control pigs. Of these, nine have died, six vaccinated and 3 non-vaccinated. Of the six vaccinated pigs that died, two showed positive to pseudorabies, of the three control pigs that died one showed positive pseudorabies

Pigs Dead

Date Vacc.	Pig Number	Vacc. Status*	Days Post-Vacc.	Cause of Death
2-12	10-1	V	3	Pseudorabies
"	10-4	V	1	Pseudorabies
"	7-4	Moribund when littermates vacc'd.		Glasser's disease (H. suis)
"	x-x	V	7	Suspect Glasser's disease (results pending)
"	8-2	V	29	Pneumonia - Bordetella bronchisepticum
"	8-4	C	29	Pneumonia - Bordetella bronchisepticum
"	8-3	V	36	Runt - cause not apparent
"	9x-1		36	Runt - cause not apparent
"	10-2	C	14	Pseudorabies and H. suis

*V - Vaccinated
C - Control

6-Week Results of Pseudorabies Vaccination in Pseudorabies Infected Herd (Al Marley Farm)

Date Test Started	Pig #	Vacc'd -V Control-C	Titer Day of Vacc.	Titer 3-wk post-vacc.	Change
2-26-77	11-1	V	16	8	Decreased
"	11-4	C	16	8	Decreased
"	12-1	V	8	32	Increased
"	12-2	C	32	32	Same
"	1-3	C	Neg	Neg	Same
2-12-77	2-1	V	256	32	Decreased
"	2-2	C	128	32	Decreased
"	3-1	V	512	8	Decreased
"	3-6	C	32	Neg	Decreased
"	4-2	V	16	Neg	Decreased
"	4-5	C	8	Neg	Decreased
"	6-1	V	8	8	Same
"	6-7	C	16	Neg	Decreased
"	7-1	V	32	16	Decreased
"	7-3	C	8	Neg	Decreased

Summary - Titers to Pseudorabies

	Number Vacc. Pigs	Number Control Pigs
3-wk. titer reduced	5	6
3-wk. titer unchanged	1	2
3-wk. titer increased	1	0

*All pigs vaccinated 3-6 wks of age.

Based on a limited number of pigs, pseudorabies vaccine did not affect pseudorabies titers 3 weeks post-vaccination of 3 6-week-old pigs. An apparent increase in deaths of 3 8-week-old pigs due to Hemophilus suis (Glasser's disease) and Bordetella bronchisepticum has occurred since the pseudorabies outbreak. Very few pigs in the study group have died of pseudorabies, and the effect of the vaccine is not yet apparent. There have been no adverse reactions to the vaccine. It is interesting to note that titers of pigs at the most recent vaccination period three and one-half months after the original diagnosis were either negative or very low.

Now for my obervations on my breeding herd. I brought two boars in, in October, which were supposed to be "clean." As I look back these boars were "off feed" a little longer than normal upon arrival.

First a herd of 30 gilts was put with five boars in October for February farrowing. Of these 30 gilts, four have had pigs; the others were eyeballed and determined not pregnant and marketed.

These gilts acted like they had Corn Harvest disease in October or first of November. As I look back I wonder if this was pseudorabies.

A herd of 24 gilts was put with five boars for April pigs. An eyeball evaluation yesterday morning (Sunday, April 3), says that 20 will farrow late in April in early May. These gilts were with the boars in the very severe January weather.

Another herd of 24 gilts is now with boars to start farrowing in June. I have higher hopes for these gilts.

My sows seem to be settling with about normal conception rates.

I will have about an eight-pig-weaned average on the sows in the farrowing house now.

What Has Happened In My Neighborhood?

1. Last July, Case 1 lost six beef cows with pseudorabies. A1 is one mile east of me.

2. Last March, Case 2 lost about 25 litters of pigs. Wayne is five miles north of me.

3. Case 3 lost three beef cattle in March, 1976, and had to sell his 250 head of cattle about 100 pounds light and subject to inspection. Max is five miles north of me.

4. Case 4, one mile southwest of me, has lost about 600 head of hogs. Both B. J.'s and my herd broke at the same time. He says I gave it to him and I say he gave it to me. We're still friends!

5. Case 5's herd broke about one week after mine. He lost six sows, some market hogs and about 30 litters--250 head of hogs.

6. Case 6 has pseudorabies now. He has lost about 12 litters and some older pigs--approximately 150 pigs. Lloyd is one mile south of me.

7. Case 7 has lost about 60 head of weaned pigs.

8. Case 8 has lost some pigs, but I have not been able to catch him to get a count.

Questions I Have For You Experts.
(I'm just an old hog farmer.)

1. How did I get the disease? Those two boars?

2. What can I do about it? Replacement boars?

3. Why, if this virus is virulent, do I lose some pigs in some litters, no pigs in other litters and all the pigs in other litters?

4. Why do pigs that test positive with high titers on one test then test very low or negative three weeks later?

5. Dr. Henchman--why test?

In Summary

I feel very strongly that I need much more research to base an opinion as to a solution to pseudorabies.

On March 15 and 16 I visited Senator Birch Bayh, Senator Richard Lugar and our Congressman Bud Hillis in Washington D.C., to tell them the story I have just told you. Nels Ackerman, Senator Bayh's administrative assistant, went with me to visit Dr. Mulhern and the others of APHIS.

Since this date I have been informed that 40 to 60 thousand dollars has been approved for this fiscal year as an emergency appropriation for 1977-78 fiscal year for research on pseudorabies.

I did suggest to both our senators that they might just pass a law against pseudorabies.

Thank you, Phil, for the opportunity to appear on this program.

VIEWS FROM PRODUCERS

Dennis Baker

In June of 1974 we lost over 300 pigs of various ages to pseudorabies. Today, our herd is considered to be pseudorabies free.

Were we lucky to have accomplished this result? Possibly, but at the same time it took a reasonable amount of time and expense to end up with our present pseudorabies-free status.

In June, 1974 we had 30 4th-litter sows farrow with reasonably large litters. At that time we were farrowing in an old barn that had 16 stalls in it. Crates had automatic waterers and the sows were fed inside the crates; the sows did not leave the crates during lactation. The oldest litters were being moved to a 6-month-old environmentally controlled, totally slatted nursery to make stalls available for new litters.

Suddenly pigs began to die. Dr. Jon Witt from the Central Iowa Veterinary Clinic at Melbourne, Iowa, diagnosed the condition as possible pseudorabies.

Dead pigs were taken to the ISU Diagnostic Laboratory in Ames, Iowa and the results were positive. Dr. John Kluge and Dr. Robert Glock of the Veterinary Pathology Department of ISU visited the farm, analyzed our situation, and suggested we try an experimental antiserum on the young pigs. No noticeable results followed and virtually 100 percent of the newborn to three-week-old pigs died. Fourteen of the litters were in the new nursery with 40-pound pigs in adjacent pens. We lost 14 or 15 40-pound pigs with pseudorabies.

It should be noted that our case of pseudorabies was the only diagnosed case in Marshall County at that time. No new animals had recently been incorporated into the sow herd. We were unable to establish any probable cause for the introduction of the disease into our herd.

Should we depopulate or maintain our present herd? Research had shown that depopulation had not worked 100 percent in other herd outbreaks, so we decided to keep our sow herd intact. The next group of sows to farrow had been in fenceline contact with the infected animals so isolation was not considered. All other sows in the herd were purposely exposed to the disease so as to build immunities.

During the next two to three months, eight or ten sows aborted their litters. None of the sows or boars showed any sign of physical sickness.

The remaining sows that completed 114 days of pregnancy farrowed in August, 1974 in the same farrowing facility. No evidence of pseudorabies was present and litters of normal size were weaned.

Replacement gilts were saved from this group of pigs and were placed in a unit across the barnyard, isolated from other pigs. Additional gilts were saved during the next six months and isolated at weaning. Unfortunately, our facilities were somewhat limited for maintaining complete isolation for mature gilts ready to incorporate into the breeding herd. As a result replacement gilts were at times directly across the fence from previously infected mature sows.

The entire sow herd was replaced with new gilts during the year following the outbreak.

In November, 1975, we began bloodtesting for pesudorabies through the Central Iowa Veterinary Clinic in Melbourne and Dr. Howard T. Hill of the Diagnostic Laboratory at ISU. Since that time every gilt and sow in the herd has been blood-tested at least once and some twice. All results have been negative. To quote Dr. Hill, "Serum samples of all the tested animals have been negative for antibodies against pseudorabies virus, indicating that these animals were never exposed to pseudorabies."

We have been very concerned since the original outbreak that it could recur in our herd. Since our herd is classified as pseudorabies-free, supposedly the only way that could happen is for a carrier animal or some other form of carrier to infect the herd. As one precaution we do not allow barnyard cats or dogs on the farm.

The economic loss caused by PRV in our herd was substantial at the time of the loss, but has to be considered minimal after three years of increased production without any of the subsequent problems associated with the disease. Approximate output was 1200 pigs per year at the time of the outbreak; current production is approximately 3000 head per year, with plans to increase to 4000.

My father, my brother, and I are optimistic that laboratory breakthroughs will minimize the effect of this disease or possibly eliminate it, but we believe that hasty and drastic procedures to combat the disease may not be the answer.

VIEWS FROM PRODUCERS
(Questions, Answers, and Discussion)

Pseudorabies would be a greater problem to the young farmers we help than to older established farmers with strong financial resources. If a farmer experiences losses from this disease and is unable to obtain needed credit from normal sources The Farmers Home Administration may be able to provide the necessary credit until recovery is made and other credit is again available.

Emergency livestock loans - a special Emergency livestock Act for FMHA guarantee of commercial lenders' loans to livestock and poultry producers in financial distress was enacted July 25, 1974, to be effective for at least 12 and not more than 18 months as determined by the Secretary of Agriculture. Loan guarantees of $2 billion were authorized. On June 16, 1975, the program was amended to authorize 90 percent line of credit guarantees. These could be made until December 31, 1976. The repayment period was changed from three to seven years with an additional three-year renewal period. On October 15, 1976, an extension of 21 months was approved. This authorized making line of credit guarantees until September 30, 1978. The top limit on line of credit guarantees is $350,000. Livestock operations cannot be expanded beyond a level equal to the highest number during the 18 months immediately preceding July 25, 1974. Applications are made to local lenders who are responsible for making and servicing the loans.

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Question for Shoup: What are your plans for future boar sales after signs of pseudorabies cease?

Continue farm operation as is -- earlier weaning, isolation of boars and gilts on another farm and sell. Some interest in positive boars also. Herd presently eliminated from sales, shows, and test stations.

Question for Pilger: Did negative animals brought into your herd remain negative?

Purchased negative animals stayed negative (not all - some get positive). The positive pigs produced stay positive even down to 20 lb. pigs.

Question for Baker: What age did you wean replacement gilts?

4-5 weeks of age.

THE PSEUDORABIES VIRUS

C. John Mare'

The pseudorabies (Aujeszky's disease) virus belongs to the herpesvirus family now known as the Herpesviridae. Included in this large family of viruses are many disease-producing agents of humans, and of domestic and wild animals.

Herpesviruses frequently cause disease of the respiratory and/or genital tracts; for example, infectious bovine rhinotracheitis and infectious pustular vulvovaginitis (of cattle), infectious equine rhinopneumonitis, feline rhinotracheitis, and human herpes simplex infection are all caused by herpesviruses.

Pseudorabies virus is a typical herpesvirus, and also causes respiratory infection and infection of the genital tract. The virus also has a strong affinity for the central nervous system, and thus causes disease characterized by nervous symptoms.

An important characteristic of herpesviruses (including pseudorabies) is their ability to go into a latent state in animals which recover from the disease. Such recovered animals may then serve as a source of virus for infection of susceptible animals brought into contact with them. In this way, the virus can be introduced to previously uninfected premises.

Pseudorabies virus is a relatively stable virus. It can survive on contaminated straw and feeding troughs for more than ten days at 24° C (75° F), and for as long as thirty days at 18° C (65° F). The virus can persist in carcasses for up to five weeks, and on contaminated wooden boards for seven weeks. At refrigerator temperature of 4° C (38° F), the virus will survive for more than six months, but freezing the virus in a conventional home freezer (-18° C, 0° F) can inactivate the virus in less than a month. The virus is rapidly inactivated by boiling, and by 1 percent sodium hydroxide, 5 percent phenol, and 2 percent solutions of formalin, sodium hypochlorite and orthophenyl phenol. It is also rapidly destroyed by lipid solvents such as chloroform and ether.

Pseudorabies virus grows readily in cell cultures derived from many animal species. Cells from cattle, swine, rabbits, dogs and monkeys are frequently used to isolate the virus, and even chicken embryo cells can be used. The virus is quite easily isolated in cell cultures from animals with acute pseudorabies, but isolation from normal carrier

animals is rarely successful. The virus can also be isolated by injecting rabbits with tissues from affected animals. Rabbits are very susceptible to pseudorabies virus and usually die within four days after inoculation with virus-containing tissues.

Swine which have recovered from pseudorabies or which have been immunized against the virus are not protected against re-infection, but such animals will usually show no clinical signs when re-infected with the virus. However, when re-infection does occur, the virus can spread through a population of "immune" swine, and thus from immune to susceptible swine.

SIGNS, LESIONS, AND REPRODUCTIVE PROBLEMS

John P. Kluge

Aujeszky's Disease has been recognized in the United States since the turn of the century. Until recently the disease was sporadic, causing death in baby pigs and occasionally cattle, dogs, and cats that were exposed to infected swine. It is now apparent that the disease is widespread in the swine population and can cause reproductive problems as well as death in all ages of swine.

Clinical signs in swine are quite variable and may be absent. In general, the younger the animal, the more severe the clinical signs. However, nursing pigs may die before clinical signs are detected. Clinical signs in nursing pigs may include any, all, or none of the following: Anorexia, depression, fever (105° F plus), vomiting, diarrhea, central nervous signs, and death loss up to 100 percent.

After weaning, pigs gradually develop resistance with increasing age. The same clinical signs may be seen, but death losses decrease to 5 to 10 percent by the time they reach six months of age. Additional clinical signs that are often noted are coughing, sneezing, and conjunctivitis.

In adult swine, deaths may occur; however, clinical signs are usually mild and may even be undetected. Signs usually include fever, anorexia, coughing, sneezing, and reproductive problems. Vomiting, diarrhea, constipation, central nervous signs, pruritis, middle ear infections, and blindness may be seen.

The effects of the virus on the pregnant female and her offspring are the most dramatic. Abortions, weak pigs, mummies, fetal reabsorption, birth of shaker pigs, and death of entire litters one to two days after birth are common.

There are no consistent or diagnostic lesions in pigs. Small white-yellow foci (2 to 3 mm) of necrosis in the spleens and livers of aborted fetuses or baby pigs are strongly suggestive of this disease. Tonsillitis and inflammation of the upper respiratory tract are often the only lesions present in older pigs. Additional microscopic lesions include nonsuppurative meningoencephalomyelitis, and ganglioneuritis. Intranuclear inclusion bodies occur infrequently.

In species such as cattle, dogs and cats, death is often preceded by intense puritus that leads to self mutilation. Death may occur without clinical signs. In either case, the only gross lesions are those that result from self mutilation.

FLUORESCENT ANTIBODY TISSUE SECTION TECHNIQUE FOR PSEUDORABIES

W. C. Stewart

For the laboratory wanting to provide diagnostic services for pseudorabies, the fluorescent antibody tissue section technique (FATST) has these advantages:

(]) The technique provides a rapid diagnosis. Specimens can be examined within 2 to 4 hours after arriving at the laboratory.

(2) The technique is less expensive than virus isolation (VI). The greatest efficiency is attained, however, when there are large numbers of specimens to examine.

(3) Perhaps the greatest advantage is the minimal amount of equipment required. A laboratory can perform the technique following acquisition of a cryostat and a fluorescent antibody microscope. Since the technique is relatively simple, it can easily be applied in most laboratories.

Some knowledge of the limitations of the FATST is also essential. Basically, there are two main disadvantages:

(]) The technique is apparently less sensitive than VI. For example, at the Veterinary Services Laboratory, pseudorabies was confirmed in 36 herds between 7/74 and 3/77. Of these 36 accessions,]5 were positive by both the FATST and VI. Eight accessions were negative by the FATST, but positive by VI. Only] accession was positive by the FATST and negative by VI. A single technique was performed on]2 accessions that were positive.

(2) Occasionally, there is a problem with interpretation stemming from the presence of nonspecific fluorescence. However, this can be minimized with proper controls. Two kinds of controls are readily available: (]) a normal serum conjugate, and (2) a blocking method which utilizes a mixture of pseudorabies conjugate and anti-pseudorabies serum. Normal serum may be mixed with pseudorabies conjugate for comparison with the latter control.

Germinal centers, degenerating leucocytes, and macrophages in uninfected tissues fluoresce nonspecifically with equal intensity when stained with the pseudorabies and normal serum conjugates. The normal serum conjugate will not stain pseudorabies infected cells.

To completely inhibit specific fluorescence by the blocking method, it may be necessary to first apply the anti-pseudorabies serum alone for]0 minutes, then decant and replace with a mixture of pseudorabies conjugate and anti-pseudorabies serum. Fluorescence is only slightly reduced in pseudorabies-infected tissues stained with pseudorabies conjugate and normal serum.

When pseudorabies is suspected, brain and tonsil specimens shoud be collected for laboratory examination. Tonsil is the specimen of choice. The specimens can be preserved on wet ice if they are transported to the laboratory immediately. However, if they will be in transit for more than 24 hours, it is preferable to freeze them in dry ice.

The method of performing the FATST is described in Table]. Fluorescence in tonsils from swine acutely infected with pseudorabies virus is often extensive and involves all cell types. Distinctively circumscribed plaques of fluorescing cells may be observed in the surface epithelium as well as in the lymphatic and connective tissues. In subacute infections, fluorescence may be confined to epithelial cells surrounding the base of the tonsillar crypts.

Finally, the FATST is a rapid and effective screening procedure for the detection of pseudorabies virus. The technique can be performed in laboratories with a minimum of equipment and technical assistance. to facilitate matters of interpretation, proper controls should be included in every examination. In all highly suspicious cases where the FATST remains negative, VI should be considered.

Table 1 - FLUORESCENT ANTIBODY TISSUE SECTION TECHNIQUE FOR PSEUDORABIES

1. Mount specimen using O.C.T. Compound (Lab-Tek Products, Division Miles Laboratories, Inc., Naperville, Ill.)
2. Cut 8 u sections.
3. Dry slides at room temperature for 5 to 10 minutes.
4. Fix sections in acetone at room temperature for 10 minutes.
5. Allow to dry at room temperature for 5 minutes.
6. Stain with pseudorabies conjugate for 30 minutes at 37° C in a moist chamber.
7. Wash in phosphate buffered saline for 10 to 15 minutes.
8. Apply coverslips to slides.
9. Read on FA microscope.

Controls

1. Use normal serum conjugate on known positive tissues as well as the specimen tissues. Use pseudorabies conjugate on known positive tissues.

2. As an alternative use pseudorabies antiserum and normal serum controls (1:1) on known positive tissues and the specimen tissues. If fluorescence is not completely blocked by the antiserum, add antiserum alone to the sections, wait 10 minutes, and then replace with the 1:1 mixture of pseudorabies conjugate and antiserum.

THE SERUM NEUTRALIZATION TEST

Robert A. Crandell

In discussing the serum-neutralization test, I will address my comments to four general areas I believe to be of paramount importance to the purpose of this symposium. With this in mind, the remarks are directed towards the application of the serum-neutralization test for the detection of seropositive porcine serum from specimens without history or recognized clinical signs of infection.

Neutralization tests may vary in technical detail according to the virus used, but all methods are based on certain fundamental principles. In each instance what is determined is the ability of the antiserum to neutralize the infectivity of the virus when in contact with it in vitro. The criterion of neutralization is that susceptible host inoculated with the virus-serum mixture do not develop detectable signs of infection within a specified period of time.

The four general areas to be considered are: (1) factors which influence the neutralization test; (2) variations in the present procedures among laboratories; (3) limitations of the neutralization test; and (4) other elements of concern.

The first factors pertain to quantitation of virus neutralization tests. Although the techniques for virus neutralization vary widely, only the constant-virus-varying-serum technique will be considered. The eight factors are as follows: (1) Virus growth conditions in assay host; (2) Virus growth curve; (3) Sensitivity of virus assay system; (4) Kinetics of neutralization; (5) Virus stability; (6) Neutralization slope; (7) Sensitivity of neutralization system; and (8) Strain differences reflected in neutralization test characteristics.

A review of literature indicates that these criteria have not been fully met for the SN tests now being employed in the respective laboratories. Most laboratories have adopted the present pseudorabies microtiter technique as a routine test from the experience with other systems rather than by a study of the kinetics involved.

The second point is variations in the present procedures among laboratories. The number of methods for detecting and measuring pseudorabies antibodies by the neutralization test vary among laboratories. The routine test common to all diagnostic laboratories is the microtiter

technique. Another feature common to the laboratories is the use of the constant virus-varying serum method. Serum titers have been determined by the plaque reduction method and by the conventional tube test, where end points were determined by complete inhibition of the cytopathic effect of the virus. These latter methods however, are not practical for the routine testing of large numbers of serum samples. Differences in the cell-culture systems, virus strains, and other procedural modifications have been reported. Time and temperature of incubation of the serum-virus mixtures vary from one hour at room temperature to two hours at 37C.

The first tube of the serum dilutions ranges from an undiluted to an initial of 1:4. Some laboratories test their serum dilutions in single rows while others test in duplicate rows. There is some inconsistency in the reporting results between laboratories. Some report the serum titer as being the inital serum dilution that demonstrates protection against virus infectivity, while others report the titer as the final dilution of serum after the addition of virus. Agreement on the reporting and interpreting of results is needed. Both are acceptable as long as the method is defined.

The third area is the limitations of the neutralization test. The first to be recognized is that detectable neutralizing antibody does not appear in the serum until about seven days after infection. It has been reported that the CF antibody appears somewhat later. Because of this time delay in the occurrence of detectable antibody the neutralization test is not recommended for the initial diagnosis of an acute illness. The fluorescent antibody test and isolation procedures should be utilized for confirming a pseudorabies outbreak. This is particularly true in cases of an acute illness in the very young pig.

Serum toxicity is a major problem, however, another is what level of neutralization or titer must we achieve to call an animal positive? The toxicity of serum to the cell culture systems is the most troublesome dealing with the present program involving animals for export and exhibition.

The use of vacutainers greatly reduced the number of toxic serum. A review of laboratory records suggests that toxic serum is not scattered randomly throughout the swine population. The greater number of toxic specimen in our experience are herd-associated and may be a reflection on the process of collection and handling of the blood. For example, over a given period of time 13 percent of the swine sera were toxic to some degree and all were from nine herds out of the 54 submitting specimens. In a few instances, where the animals were rebled with added caution, the serum was still toxic upon resting. However, rebleeding and retesting of animals is an additional financial burden and time requirement.

It was suggested that perhaps some unidentified factor other than impurities in the tubes is responsible for some toxicity. To overcome toxicity, serums are being diluted before testing in some laboratories. This automatically reduces the sensitivity of the test.

Other limiting factors to the serological test are biological contamination and breakage in transit related directly to the collection and handling of the specimens. The amount of hemolysis in the sample has an influence on the acceptability of the specimen.

One final comment on limitation of the neutralization test is the question of whether or not the diagnostic laboratories have the capability to perform the required numbers of tests in pursuance of an eradication program.

The fourth area I want to discuss is virus strain differences, cross reactions with other herpesvirus, and the significance of minimal neutralization titer.

Differences however have been reported among field strains and variants in regard to their plaque morphology, virulence, and sensitivity to temperature.

Last spring I presented some preliminary serological data to the LCI pseudorabies committee in St. Paul suggesting the possible existence of antigenic variation among some pseudorabies isolates. Preliminary studies that cross SN tests with different field viruses suggest a difference in the neutralizing capacity of the serum for the different viruses. The data we obtained were not conclusive, but indicated that antigenic analysis of field strains of pseudorabies virus should be studied using more senstitive methods. In support of this concern, this information may be important in the strain selection for a better antigen for use in the SN test.

Another area for consideration is the cross reactions among the members of the herpesvirus group. Cross serological reactions have been recognized for years between certain members of the herpesvirus group. We have encountered a cross between pseudorabies virus and IBR antibody in bovine serum and IBR virus and porcine hyperimmune pseudorabies serum by the serum neutralization test. The pseudorabies virus cross with IBR antibody was common in the few bovine serums examined. Since IBR virus has been isolated from swine and IBR antibody has been reported in swine serum, the potential of a false positive pseudorabies titer exists. The specific antibody can probably be determined by testing the serum with both viruses.

Another question to resolve is: What is the minimal demonstratable titer of a porcine serum to consider positive for pseudorabies? Some feel that any titer is positive. Titers of 1:4 (final serum dilution) determined by the neutralization test have been shown by the South Dakota laboratory and ours to be positive, also by the indirect fluorescent antibody (IFA) test In a few instances single serums from clean herds have been positive at 1:4 on the inital test, but were negative upon retest. The IFA test has confirmed these as being negative.

If we should adopt a screening procedure of testing undiluted serum, it is possible that more specimens will neutralize the virus at higher serum concentration. It will be these few serum that will cause some concern. Additional studies with the IFA test are required. Another approach to this problem is to bring animals with these minimal titers to the laboratory and stress them in isolation in an attempt to reactivate the virus.

Fresh complement has been reported to enhance the pseudorabies titer 6-fold.

Another question paramount to a control program for the detection of seropositive animals is what percentage of a herd requires testing in order to determine the serologic status of a given herd. Studies in Europe have shown that the incidence of antibody carriers among boars does not in itself reflect the frequency of infections in the swine population as a whole. However, it is a useful indication of the presence of infections and dissemination within certain geographical areas.

SKIN TEST

Paul C. Smith

Evidence indicates that the intradermal injection of heat-inactivated pseudorabies virus antigen has the potential to become a simple, rapid, easily administered, virus-specific test for chronically infected or previously exposed animals. The use of the same antigen injected subcutaneously in the lower eyelid may prove to be more readily adapted to field use because of the ease with which it can be administered and evaluated.

The test should be evaluated in known natural outbreaks of pseudorabies virus-infected herds and correlated with virus isolations and humoral antibody evaluations before widespread use can be recommended. This type of positive response usually indicates chronic infections or at least previous exposure to the virus. The logical questions then begin to arise, such as: How reliable is the test? Does it compare to other diagnostic tests?

In Europe, Drs. Haralambiev and Yotov conducted a series of experiments in naturally and experimentally exposed swine. Their skin test antigen was prepared by alcohol precipitation of viral suspensions. In their test, 95 of 119 aged sows tested after an outbreak of disease were positive to the test. Eighty percent of the animals in the herd showed evidence of previous exposure and all 95 skin test positives had virus neutralizing antibodies in their sera. Twenty-three seronegative animals failed to respond to the test. Finally, 26 animals that had never been exposed to the virus and had no detectable antibody in their serum were injected with the skin test antigen. They failed to develop antibodies in their serum 15 days after injection. This report tends to confirm our limited experience that the test is highly specific, correlates well with virus serum neutralizing antibody development and does not cause antibody development by a single injection.

The potential use of the test involves several areas of special interest to the swine producer and the practicing veterinarian. The primary use in a control or eradication program would be its value as a field test to determine chronically infected herds in the absence of clinical disease. Another use would be to determine the cause of abortion storms or infertility without other clinical symptoms. Of special interest to the feeder pig producer or purebred seed stock operator would be as a preliminary test for breeding animals to be added to the herd. An incidental finding that the antigen effective in the skin test can also be used in agar-gel diffusion tests to determine the presence of antibody in serum from naturally infected swine.

DISCUSSION FOLLOWING THE SESSION ON DIAGNOSIS OF PSEUDORABIES

An enlightening discussion followed the session with the majority of questions and comments focusing on the serum-virus neutralization test and the skin test. It was the general opinion that standardization of diagnostic tests is needed, a problem that Dr. Crandell dealt with in great detail. It was explained to the audience that the American Association of Veterinary Laboratory Diagnosticians has a new committee that is working toward a goal of standardized diagnostic tests, particularly the serum-virus neutralization test. Both Dr. Crandell and Dr. Stewart indicated that although there are minor differences in reagents and protocols used, the microtitration serum-virus neutralization test is very reliable and end results are reproducible between laboratories.

Questions and comments about the skin test were numerous. Dr. Csentos indicated that in his experience, animals tested with a skin test antigen developed antibodies in 3 weeks. Dr. Smith stated that his work did not indicate this to be a problem.

Dr. Kluge's remarks about repeat outbreaks of pseudorabies in the same herds elicited comments and concern from the audience. The general opinion was that because of these repeat outbreaks and because of the subsequent reproductive problems in some herds, this disease will be hard to "live with."

EPIDEMIOLOGY OF PSEUDORABIES--IOWA

D. E. Weaver

Pseudorabies is probably the most variable and unpredictable disease that we have ever experienced. Therefore, we should not expect it to fit any type of a pattern that we think it should. Over the years we have all been familiar with the isolated mad-itch cases in cattle. Then a number of years ago the virulence began to increase.

The first real severe outbreak that I was associated with was in Cherokee county in 1968. This farmer had purchased feeder pigs and put them in the feedlot with some 1000-pound heifers. About two weeks later, one of the heifers developed the typical mad-itch syndrome of pseudorabies. In this case it was caused by bites from the pigs. The pigs were immediately separated from the cattle, but over the next 12-day period, 17 heifers died.

My next experience was during the summer of 1970. I received a call from a veterinarian who suspected that he had the nervous form of hog cholera in some pigs. In March of 1970, we had our last case of hog cholera in Iowa so this was just a few months later. These were a group of three- to four-week old pigs that were showing a tremendous amount of CNS symptoms. Today, it would be a typical case. At that time I knew it was not hog cholera, but I did not know that it was pseudorabies. I autopsied five or six pigs and took tissues to the laboratory at Ames for a diagnosis. No diagnosis was obtained but I was informed they did not have hog cholera. So I went back to the farm, took more tissues, and again went to the lab with the same results! No diagnosis.

So the next step was to get on the telephone and ask for ideas from the laboratory. After a long conversation they asked me if I had thought of Aujeszky's disease. Naturally, I had never seen it in a pig. I obtained some fresh brains, took them to the laboratory where they injected some rabbits, and sure enough, a typical case of Aujeszky's disease. This pork producer lost 50 percent of his pig crop.

Then in 1972 in Sioux county, I was called to five or six farms with outbreaks of pseudorabies and each of these farmers lost 300 to 500 baby pigs. Since then the cases have increased in number. Last year (1976) Iowa had about 225 cases; Iowa has about 291 cases so far in 1977. My nine counties in northwest Iowa had 144 cases in 1976 and 175 cases so far in 1977. This is 62 percent of the cases in the state.

About three weeks ago I went to a farm in Cherokee county. They had pseudorabies in swine exactly two years ago and had lost all the pigs from one farrowing of 20 sows. They have had no clinical signs of the disease since that time. They have buildings on both sides of the road. They had been keeping the cattle and sheep on one side of the road and

the swine and horses on the other side. This spring they became cramped for space so they moved 14 purebred Suffock ewes across the road and into an adjacent pen in the barn. Only a wire panel separated the ewes from the pigs. About a week later one of the ewes developed the typical mad itch syndrome around the ear area. The ewes were immediately moved out of the barn and away from all the swine. Over the next nine days, 13 of the 14 ewes died from pseudorabies. At first I thought the ewes were getting nipped through the fence but on closer examination, I believe the ewes were ingesting or inhaling the virus.

About two weeks ago, I was contacted by a dairy farmer who had a beautiful Holstein herd. Seven of his cats died, so two of them were sent to the laboratory and a pseudorabies diagnosis was made. He has had no other problems. The cats had to be contacting the virus from a neighbor. We have had no known cases of pseudorabies within 10 miles of the premises; but some one in that area should be having some problems. Without an eradication program, we don't have the time or money necessary to find the other case. Now we just wait for it to show up.

Last week I received a call from a veterinarian with a client who lost six big steers in two days. On checking into the case, the owner had purchased Minnesota feeder pigs and had put them fence to fence with the cattle. There was drainage from the pigs to the cattle lot. Sometimes, one fence is not enough separation. I believe we are approaching the time when we will have complete separation between swine and cattle.

Last week I investigated a case in Plymouth county. The owner went out in the morning and there was a skunk in the hog lot and his half-grown dog was harassing the skunk. The owner shot the skunk and disposed of it. About a week later, he had a severe case of pseudorabies. The dog died and there is a big death loss in the pigs. The probable cause of the outbreak is the skunk. But in many of the outbreaks, we have a number of possible causes. Many times boars or gilts were purchased, maybe two to six months before. They are usually not tested for pseudorabies. Some of these outbreaks caused by swine movements occur within a week or two, but sometimes it may take months for the virulence to build up so that clinical signs appear.

We believe that dogs and cats can spread pseudorabies. Most people don't tie up their dogs and most believe their dog does not run around at night. When driving at night, I see many dogs on the roads between premises. I've been told that cats may travel 7 or 8 miles at night. Most farms have stray tom cats around. We believe other wild animals, such as raccoons, will spread the disease. In some areas with many outbreaks, we have had a large number of raccoons that have died. If we see one in the hog lot and about a week or two later we have an outbreak, then we blame the raccoon. Sometimes, dead raccoons have been found in cattle water tanks but we have had no pseudorabies problems in the cattle.

We believe that rats will shed the virus. In some of these closed-up, environmentally controlled buildings, the owner will remember seeing many mice and rats shortly before the outbreak. So we blame the rats and mice.

How about birds? Are they ever mechanical carriers? I don't believe they are a big spreader of pseudorabies.

I believe contaminated water will spread the disease. I have investigated cases where one neighbor gets the disease and it seems to spread downstream to a number of farms where swine have access to the water.

We have to be more careful about the mechanical spread of the virus. This includes trucks, chutes, and owners going to auction markets and slaughter plants. Sometimes, dead pigs and afterbirth are thrown on the manure spreader and taken to the field. Proper disposal is necessary. Some of the pork producers take pigs to hog shows and take them back home without isolation and testing.

In most of these outbreaks, we have a number of possible sources that could have caused it. Many times it is a guessing game as to what caused the outbreak. What it really takes is a lot of time spent on these farms asking questions. To do a good job it will take anywhere from two to five hours. Most of the time we don't have that much time to spend on these outbreaks. I believe most of the spread from one area to another is caused by swine movements. After the disease is established in an area, then these other methods of spread become important.

What we need is a program to stop the disease from spreading from one farm to the next. And we need this immediately. So we have to control all the possible ways that the disease is spreading. We can't just control part of them or the ones where we have a personal interest, and then forget about the rest. To do this, it takes time on these farms and a lot of educating for the neighbors.

We also need a program to clean up those herds that already have the disease. I'm a firm believer in eradication, but to do it by depopulation is out of the question. It is way too late for that. It was probably already too late a year ago, but most people did not realize it.

Pseudorabies is much too costly to live with, so eradication is the only answer. Immediate programs to control and eradicate are a necessity. Every delay is very costly to the swine industry.

We have an obligation to clean up the infected herds, but we have a bigger obligation and responsibility to protect the large number of herds that have not had the disease.

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EPIDEMIOLOGY OF PSEUDORABIES

South Dakota - M. W. Vorhies

The incidence of pseudorabies virus in South Dakota illustrates a progressive increase beginning in 1974.

1973 - 0	1975 - 3
1974 - 6	1976 - 30

The monthly distributions of confirmed cases during 1976 revealed no significant seasonal variation. The number are more likely related to farrowing patterns in this area.

Jan. - 0	May - 2	Sep. - 2
Feb. - 5	June - 3	Oct. - 7
Mar. - 0	July - 0	Nov. - 6
Apr. - 3	Aug. - 1	Dec. - 1

The evaluation of recorded cases must take into account that when the disease becomes common in a local area, the submissions to the laboratory decrease. The local recognization by producers and veterinarians reduce the need to submit specimens for confirmation. The number of cases reported for each county in South Dakota then may represent just a small percentage of actual cases.

Diagnosis by South Dakota Counties

Union - 10	Brookings - 7	Clark - 1
Lincoln - 4	Kingsbury - 3	Corson - 1
Minnehaha - 1	Beadle - 1	Harding - 1
Turner - 2	Hand - 1	Brown - 1
Charles Mix - 1	McCook - 1	Fall River - 2
Hutchinson - 1	Spink - 1	

Visiting with producers in Union and Lincoln counties indicates a very high percentage of infected herds. The primary sources of infection would appear to be movement of feeder pigs and their exposure to breeding swine. The second most common history is the addition of boars and gilts to the breeding herd.

Source of Infection, South Dakota

Purchased --	Feeders	- 8
	Boars	- 3
	Sows or Gilts	- 7
	No History	-12

Because of the small size of the South Dakota swine industry and its concentration in the Southeast section of the state, pseudorabies control and eradication may be possible.

The control of feeder pig movement and requirement of a negative SN test for sale of all breeding animals would appear to be the first control procedures necessary.

EPIDEMIOLOGY OF PSEUDORABIES

Paul L. Spencer

While sporadic reports of Pseudorabies had been noted by practicing veterinarians in Illinois, principally in feedlot cattle being followed by swine, throughout the 1940's, 1950's, and 1960's, no serious losses in swine were recorded until late in 1973. This outbreak occurred in farrowing operations in northern Calhoun County, Illinois. All of these premises were in an approximately three-square-mile area. In addition, cases were reported in neighboring Pike County.

In the spring of 1975 the second Illinois outbreak, also in farrowing operations, occurred in Cass County, Illinois. The affected farms were again in close proximity. Severe baby pig losses plus some losses in feeder swine and in sows were suffered by the producers concerned. No relation between this outbreak and the earlier Calhoun County outbreak was ever established. One of the producers involved has made an estimate of the overall economic loss to the Cass County community as a result of the outbreak at one-half million dollars. In addition to the Cass County outbreak, pseudorabies was also diagnosed on one premise each in the neighboring counties of Pike and Morgan, and on single premises in Edgar and Clark Counties in eastern Illinois through pigs submitted to the University of Illinois Veterinary Diagnostic Laboratory.

From the fall of 1975 through the spring of 1976, a total of 62 laboratory-confirmed cases of pseudorabies virus was diagnosed in the state of Illinois. The heavy concentrations were in Pike County (35 cases) and Henry County (eight cases). Although the dots marking the outbreaks are dispersed throughout the counties for purposes of clarity, most of the Pike County cases were confined to the northern half of the county, and we now consider pseudorabies virus to be endemic to this area. The Henry County cases were confined to about a five-mile-square area. Although feeder pigs were affected on some farms, the heavy death loss was in newly farrowed pigs or in recently weaned pigs in nurseries. To the best of our knowledge, all of these outbreaks were in farrowing operations with the exception of the one in Iroquois County, which was diagnosed in imported feeder pigs.

From the fall of 1976 up to the present time, the pattern has been much the same and in the same general areas, plus some new counties. The two highest Illinois swine-populated counties, Henry and Pike, continue to have the greatest number of cases. Although the incidence rate is slightly below that of the previous year as far as laboratory-confirmed cases is concerned, we have no reason to believe that the disease is diminishing. Rather we know that it is spreading to counties where it has not been reported previously, such as Macoupin, Tazewell, Woodford, LaSalle, Kane-Kendall and McHenry. Cases continue to be confined to swine farrowing operations with a few exceptions: (1) a premise in McDonough County had a death loss of approximately 60 ewes and baby lambs in March 1976, followed by a loss of about 60 imported feeder lambs in June and finally diagnosed in feeder swine in November; (2) premise in LaSalle County where the disease

appears to have come to the premise with purchased feeder pigs and then spread to the farrowing operation; (3) premise in McHenry County which has 1,300 native feeder pigs on feed. Of interest here is the death loss of 13 head of fat cattle between the last week of January and the first week in March. These cattle were in a feedlot adjoining a swine-feeding floor; 20 head of feeder swine were lost during the same period, some with CNS signs and some merely found dead. We also encountered a death loss of 14 fat cattle last winter on a Pike County farm where a diagnosis of psuedorabies virus was made in the cattle, but no clinical signs ever appeared in the feeder swine running with the cattle. In addition, feedlot cattle losses of one to five head occurred on five other farms in Pike and Scott Counties. The implications of the spread of pseudorabies from swine to feeder cattle in the same adjoining lots is a new aspect of the disease that must be given consideration in the future.

THE ROLE OF WILDLIFE AND DOMESTIC ANIMALS

Charles L. Kanitz

Along with the recent increase in incidence of pseudorabies in swine, an increasing number of infections are being seen in other species. The actual role of other species in the epidemiology of pseudorabies is not entirely known. Several species which previously had been considered to be dead-end hosts are now known to shed virus and have been implicated in the spread of the disease among swine herds in endemic areas. Most notable of these are raccoons, whose natural habits and high susceptibility to infection make them ideal infected vectors within their range area. Recent studies at Purdue University have shown that the virus can be transmitted from pigs to raccoons and from raccoons to pigs through contact exposure, eating at the same feed trough, and by eating infected carcasses. Virus shed in saliva from infected raccoons may also contaminate feedstuffs and serve as a source of infection for ruminants.

The epidemiology of pseudorabies in opposums is similar. They are not as likely to be involved in spread of the disease, however, since they do not coexist with man as well and there are not as many of them.

Carnivores, such as dogs, cats, skunks and foxes, are also readily infected by eating improperly disposed of dead pigs. Their infected carcasses can, in turn, serve as a source of infection for a susceptible swine herd if they move onto the premises before they sicken and die.

Rodents have often been charged with playing some role in the transmission of pseudorabies. However, studies conducted on rats from infected pig farms and on orally inoculated rats have shown that they are quite resistant to infection and do not shed virus when they are infected. Common conclusions from these studies are that rats are not likely to be a reservoir for pseudorabies or to play an important role in its spread. Mice have been found to be even more resistant to infection than are rats.

Recent observations indicate that pseudorabies virus may be shed by infected cattle and sheep. During the last year in Indiana, infections of these species have usually involved the respiratory system, from which virus was readily isolated. Clinical observations indicate that lateral transmission occurs, particularly in sheep where nearly entire flocks have been lost without any direct contact with swine. This apparent change in pathogenicity of pseudorabies virus for these two species warrants further study of its possible significance in the total picture of the epidemiology of the disease.

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EPIDEMIDOGICAL STUDIES OF PSEUDORABIES IN IOWA

George W. Beran, Jerry Kunesk, Howard Hill

This report summarizes two very different types of epidemics of pseudorabies in swine in Iowa. The first was a clinically devastating epidemic of what has become the classical form of pseudorabies in this state, and involved 16 farms in one county.

The epidemic spread over a 16-month period in three interrelated foci. There is strong epidemiological evidence that the pseudorabies virus was introduce into each focus through carrier swine. In the first focus, the disease started with an attack rate of 22 percent in the apparently susceptible portion of a mixed lot of feeder pigs. When the infection spread to resident pigs on another premises operated by the same owner, the clinical attack rate was above 93 percent. The introduction of the pseudorabies virus into the second focus was apparently through a clinically unrecognized transmission to breeding stock by sows brought in from an infected farm in focus number 1. The virus was apparently then inadvertently introduced into focus number 3 in carrier boars.

The epidemiology of the spread of pseudorabies within the foci has not been fully determined. Except for movement of pigs between premises of the same owners, there were no movements of swine among farms involved in the epidemic. In focus number 1, only 11 farm outbreaks were recorded among 113 farms, approximately 75 of which had swine. Only 5 of the more than 60 hog farms where the disease was not recognized could be serologically surveyed; 1 showed evidence that the infection had gone through unrecognized.

There was strong epidemiological evidence that where serologically negative breeding animals were mingled with serologically positive convalescent sows or boars, clinical disease did not appear in the susceptible stock until times of stress by transport, farrowing, lactation or other stress.

The epidemic caused actual losses of $109,007, or $6,813 per farmer involved, plus potential profit losses of $353,580, or $22,099 per farmer. The overall economic impact of the epidemic was calculated at $462,587, or $28,912 per farm outbreak.

Evidence of the role of dogs, cats and wildlife in the epidemiology of this epidemic is incomplete. These animals probably entered into the chains of infection on all but two farms in focus number 1. Dogs, which were present on 11 of the 12 farms plus one non-farm residence involved, were most commonly diagnosed as infected, being reported on five farms with swine cases, one farm with no swine cases and one non-farm residence. In all seven instances, the dogs involved had access to or had been observed eating carcasses of dead pigs or

placentas of infected sows. All dog cases occurred at the same time as swine cases, and all were fatal; there was no evidence in this focus that dogs may have transmitted the virus to swine or to other dogs.

Cats were present on all farms involved and were suspected to have the disease on six farms; two of three carcasses submitted for laboratory examination were confirmed. One confirmed and one suspected case in cats occurred on these farms one to three weeks before the appearance of pseudorabies in swine. Suspected cases in seven skunks found dead in or near a hog pasture at the same time as the swine cases and in six raccoons found sick or dead in or near hog lots during or in one instance one week before the appearance of swine cases were reported by the farm operators. The single raccoon carcass submitted for laboratory diagnosis was positive.

No evidence has been obtained for carrier states in normal dogs, cats or wildlife. Thirteen normal cats, 17 normal rats and one mouse, and ten normal resident birds captured on farms with swine cases; and 95 raccoons, 32 foxes and one coyote trapped or shot within the epidemic area were all negative by laboratory examination.

In swine, once the clinical disease appeared in swine on a farm, it spread through the herd in contact within five days to four weeks. Serological studies on such herds indicated that 100 percent of the animals were infected. In one herd of 80 weaned pigs tested as convalescent animals, the geometric mean titer was 1:58. After 3 ½ months the mean titer was still 1:55 but individual animals showed titer variations $\geq$ two-fold up or down in 31 percent of the serum pairs.

Several post-outbreak procedures were followed by farmers involved in the outbreak. One farmer depopulated his herd of swine completely and three months later safely introduced clean stock. There was no evidence of maintenance of the infection in wildlife or other species One farmer who sold all but selected seropositive breeding stock was unable to prevent infection in clean stock introduced in contact with these remaining convalescent gilts. Farmers who kept convalescent sows and selected gilts from convalescent animals experienced no further disease problems. One such farmer, however, who saved 50 second generation gilts experienced a second outbreak in which he lost two gilts and 400 pigs four to seven weeks old. In the initial outbreak he had lost one gilt and 340 pigs under six weeks of age.

Another farmer, in an area outside that of this epidemic, adopted a plan of purposeful exposure of gilts brought on the premises by placing them with convalescent swine for two months before breeding.

For six months he achieved 100 percent serologically positive animals but in January 1977 only 83 percent in February only 33 percent and in March 0 percent.

The second epidemic, which is still in progress, is identified as involving three farms on which it is characterized by entirely subclinical infection. Epidemiological evidence is that introduction of the virus was through shows in August and early September 1976. One serologically positive boar was recognized in October which had been sold to a farm not in a pseudorabies-infected area. The presence of the infection on the three study farms has been monitored serologically since October on one and December on two.

The virus has shown unique and similar characteristics on the three study farms.

1. Infection by this strain has been entirely subclinical. Although the swine involved were initially serologically negative and though swine of all ages and in all stages of gestation, farrowing and lactation have been present on all three farms, no clinical or necropsy evidences of infection have been present.

2. The spread of the strain through the herds has been relatively slow. On one farm where monthly serological surveillance has been conducted, 20 of 38 breeding stock (53 percent) were serologically positive in november 1976. Although serological conversions were subsequently recorded each month, only 76 percent of these animals were serologically positive in March 1977.

3. Serological titers in convalescent animals have been relatively low, with a geometric mean of 1:12 in breeding stock.

4. Serological titers have decreased relatively rapidly and have frequently decayed below detectable levels. Among 118 animals tested in February and March, 68 titers remained constant, none increased, and 23 decreased with 20 of these going from positive to negative.

5. There has been no evidence of transmission involving anmials other than swine on the three farms.

Finally, on one farm where serologically negative pigs are being moved to a separate premises following weaning, pigs of serologically positive dams have lost their maternally acquired antibodies by six to eight weeks of age. A total of 194 weaned pigs transferred to the second premises have remained serologically negative at four months of age. Ten of these which were brought into a laboratory isolation unit and subjected to a physical and drug stressing for five days have remained serologically and virologically negative through two weeks at this time.

SURVEILLANCE AND INCIDENCE REPORTS FROM STATES REPRESENTED
OKLAHOMA

Two outbreaks of pseudorabies virus infection in swine have been diagnosed during 1976 in Oklahoma. Some 2258 of 330,000 Oklahoma swine from 349 herds held in 56 of 77 counties were tested for PRV antibodies over a 7-month period and 8 (0.35%), representing 3 herds, were positive. Evidence of infection (virus isolation or serologic reactors) has thus far been found in five counties representing the northwest, southeast, eastcentral, westcentral, and Panhandle areas of the state.

Although the swine population of Oklahoma is relatively small (330,000 swine), swine breeders and producers in the state are progressive and dynamic and the industry is growing rapidly. Pseudorabies has, in recent years, been occurring in swine with increasing frequency, and has become a significant threat to the economic health of the swine industry. Although the alarming incidence of the disease is known in many parts of the U. S., reports of the disease in the south and southwest are very scanty.

We now report findings of the Oklahoma Animal Disease Diagnostic Laboratory on the occurrence of pseudorabies virus in Oklahoma swine. Virus isolation attempts were made by conventional methods from 15% swine tissue suspensions in swine testicle cell cultures.

Virus identification was carried out by serum virus neutralization, the indirect fluorescent antibody test, electron microscopy and rabbit inoculation.

A survey for PRV antibodies in swine was conducted. Most serum samples originated from swine destined for shipment to other states and originated from 2258 swine representing 349 herds held in 56 of 77 counties of Oklahoma. The test was the serum virus neutralization test using 30 $TCID_{50}$ of virus.

PRV was isolated from piglets originating from two herds (one in eastcentral and one in westcentral Oklahoma). The isolations were made in May and December, 1976 from 2- to 3-week-old pigs which had died after a brief disease characterized by CNS signs.

Serologic investigation was done in one of these herds indicating that infection was quite widespread in the herd. However, in both instances, the disease was not explosive and only a relatively few litters were affected. In some instances, only some members of litters developed the disease.

The serologic survey included 2258 swine from 349 herds held in 56 of 77 Oklahoma counties. Antibodies were found in 8 swine from 3 herds in 3 different counties (one herd in northwest Oklahoma, one herd in the Panhandle, and one in southeast Oklahoma). Swine were not clinically

ill in 2 of the 3 latter herds. The serologically positive hogs in one of these herds had been on the "show circuit" and a serologically positive hog from another herd originated from Illinois via a sale in San Antonio, Texas.

These data may suggest that the incidence of PRV in Oklahoma may be relatively low since only 0.35% of the sera (from 3 of 349 herds) were positive. However, only 0.68% of the swine in Oklahoma have been tested which does not represent a statistically valid number to accurately estimate the incidence of the virus in the state. The virus seems to be quite widespread though, since evidence of infection was detected in 5 counties representing the southeast, northwest, eastcentral, westcentral and Panhandle areas of the state.

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EPIDEMIOLOGY OF PSEUDORABIES

Questions, Answers, and Discussion

To date there have been four national accredited SPF herds with a positive SN test for pseudorabies. One additional herd had one pig positive on FA, but later all the breeding herd tested SN negative. Of the SN positive herds, one has had no titres over 1:8 and no clinical signs. Two of these herds are primary SPF herds in which all additions are from an SPF laboratory. The other three herds are secondary SPF herds, meaning that at one time or other breeding stock was purchased from another accredited SPF herd. One of the herds has three sows with SN titres but has since completed three negative herd tests and no clinical signs.

Any SPF herd with a confirmed diagnosis of pseudorabies is suspended from accreditation.

It appears the most common means of pseudorabies transmission is from hog-to-hog contact. If this is the case, one would expect less exposure to the disease when the producer is following good isolation, disease control and the closed herd concept, as is the case with SPF producers. The herds are either totally closed to outside breeding stock (primary) or to only breeding stock from another SPF herd (secondary). They don't purchase breeding stock from sale barns nor from unknown sources, nor do they bring breeding stock (primary) or to only breeding stock from another SPF herd (secondary). They don't purchase breeding stock from hog shows. This closed-herd concept can and is followed by producers other than those enrolled in the SPF program.

SPF producers are encouraged to test sows before taking them to an SPF lab for C-section. To date lab operators have reported that all Caesarean-derived pigs have tested negative for pseudorabies--even those from positive SN sows. One SPF lab did C-sections on 25 or so positive sows for a producer as a means of salvaging the pseudorabies herd and reported that all pigs have been negative for pseudorabies. This C-seciton procedure appears to be one method in which a positive pseudorabies herd of outstanding quality can be salvaged rather than marketed

In summary one would expect fewer incidence of pseudorabies in SPF herds or others following good disease control and the closed herd concept. This doesn't mean the SPF-herd located in an area with a high incidence of pseudorabies will totally escape pseudorabies infection, as there are apparently carriers other than hogs.

RECOMMENDATIONS OF PRACTITIONERS TO PRODUCERS

Missouri - John M. Perry

Because of the disastrous losses in the acute outbreaks we have had, our main recommendations to our producers have been aimed at prevention. The following concepts have been used in the "clean herd:"

1. Closed herd concept - even in most purebred herds - any additions are quarantined for 60 days before any herd contacts are allowed. Both boars and gilts. During this time a second round of leptospirosis and erysipelas vaccinations are given. Blood test for pseudorabies and Bangs are both repeated. Barrows and/or better market sows contacts are allowed for the last 30 days for SMED $\pm$ viral exchanges to occur. Then another 30 day contact to breeding herd before using if clean to pseudorabies and Bangs on tests run 45-50 days after entry into quarantine.

2. Most of the failures to remain clean are because of the producer buying extra feeder pigs, piggy sows, just not observing the other concepts of the closed herd.

Recommendations to the infected herd: Keep own sows, try re-establishing a clean herd. We have had reappearance of the symptoms of infertility and pig losses if you try to live with pseudorabies. Use a second quarantine area to establish clean gilts and start a closed herd concept all over again.

RECOMMENDATIONS OF PRACTITIONERS TO PRODUCERS

Harry Bosworth

Our recommendations to the swine producers we work with would probably be best broken into two groups. Those that have had the disease and those that do not.

We have had the disease in our area for three years and each year we have had more herds infected. The economic loss has been severe in some herds and very minor in others. Continuous-farrowing herds are the most susceptible to a high death loss.

We have fed pigs that have died from the disease to all sows once the infection has started. The viscera from the dead pigs are fed to sows every three or four days, and sick sows are mixed with pens of healthy sows. We like to spread the disease in the herd as rapidly as possible. In some outbreaks, we have had swine in the same herd sicken six weeks after the first signs of the disease when the disease was left to run its normal course.

We have considered freezing some of the pig viscera for later use on the herd but the best information we can get is the virus is killed by freezing in 60 days or less.

Serum produced from immune sows has given us varying results. The best results were gotten by giving the serum to pigs as soon as possible after farrowing, when the nursing sows had recovered from the disease.

I think until we have a method to keep these herds immune, we will have to use serum on outbreaks that keep reoccurring in infected herds. The sows that are carriers can shed the virus during stress and start an active infection among the little pigs.

Do not wean pigs under four weeks during an active infection. The death loss on weaned three-week-old pigs is 20 percent higher than for nursing pigs. We have used some serum on these three-week only pigs and had very good results even on the ones showing infection.

We have not always been able to develop an immune herd and keep it immune. Some of the herds have SN negative pigs that are susceptible to the disease. When we add these pigs to the herd as gilts, they have become infected as long as two-years later, some in six months or a year.

As far as the herds that are not infected, we rely on the SN test. We have taken close to 400 samples and found the test very reliable in correlating it with virus isolation from the herd earlier. In young pigs, it takes at least six weeks for a titer to develop. In sows, at least five-weeks to give a reliable titer.

I think our biggest problem with pseudorabies is the carrier animal and we feel that the SN test is the only method we have of detecting them. If we can control the carrier animal, I think we can slow the spread of the disease.

All additions to the herd are tested and we recommend that they retest after 30 days isolation.

In going from infected herd to clean herds, we use disinfectant and change coveralls but I don't believe we are very apt to spread the disease by direct contact.

PSEUDORABIES CONTROL AND ERADICATION: RECOMMENDATIONS TO PRODUCERS

Richard D. Hull

The aggressive form of pseudorabies first appeared in the swine industry in Pike County, Illinois, in the spring of 1974. There was a mortality rate in this case in excess of 50% prior to treatment. When a tentative diagnosis of pseudorabies was made, concentrated anti-hog cholera serum was administered at the rate of 7 cc per 20 pounds of body weight. The response was dramatic with only 2 pigs dying after treatment, but in recent outbreaks this therapy has given poor to no results.

The numbers of cases continued to increase in the county and by the fall of 1975 three large producers had experienced the disease. With funds made available by the Illinois Pork Producers Association pseudorabies antiserum was produced and use initiated in January of 1976. The response to this serum was more effective with experiments showing a survival rate of 28 percent in treated pigs over control pigs.

As the number of cases grew, concern also grew and it was agreed that controls should be established on a herd basis. Producers were advised to isolate sows that had experienced the disease from the remainder of the pseudorabies-free herd. In most cases this procedure failed, with sows and pigs breaking with the disease when they were brought into the farrowing unit.* It was recommended that all breeding stock, following an acute outbreak in a commercial herd, be exposed by placing sows which had lost pigs from pseudorabies with the gestation herd. Exposure should not occur 2 weeks before or two weeks after breeding.

Caution should be made in purchasing additional stock to the pseudorabies-free herd. Only animals that have a SN negative titer 3 weeks prior to and 3 weeks after arrival should be commingled with the original herd.

Since the first case of pseudorabies, Pike County has experienced over 40 confirmed cases in swine herds and this does not include cattle or dogs that have died from the disease. If asked to take a stand for eradication versus vaccination and/or do nothing, I would have to pass pending the conclusion of this meeting, but to initiate an eradication at the present time in this heavy swine producing area would probably be more devastating than the disease itself has been.

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*SN titers were checked on these sows prior to and 2 weeks after arriving in the farrowing unit.

RECOMMENDATIONS OF PRACTITIONERS TO PRODUCERS

E. A. Butler

The State of Iowa has the dubious honor of having more pseudorabies than any other state. Of course, we have more hogs than any other state. The present procedure calls for reporting of all known cases of the disease. When a disease outbreak is reported, the producer is quarantined for 30 days after the clinical symptoms disappear.

The producer is sent a certified letter telling him that the quarantine will be released in 30 days, but that his hogs are still potentially dangerous and breeding stock should not be sold, and feeder pigs sold only to those who have been informed that the pigs have gone through an outbreak of pseudorabies.

There is quite a bit of disagreement on length of quarantine time or the imposing of quarantines at all. Some veterinarians in practice in the endemic areas think that all infected herds should be quarantined until slaughter. Other veterinarians are reluctant to report the presence of the disease because quarantines are issued and they don't wish to have the stigma of a quarantine placed on their client's farms. This idea is far more popular than the policy of quarantining infected herds to slaughter.

We also recognize that very likely many cases of pseudorabies are not seen by practicing veterinarians. Since the symptoms of the disease are quite distinctive and there is very little a veterinarian can do to alleviate the losses, the veterinarian may not be called.

In Iowa, we have many fairs and exhibitions. So it follows that there must be some controls. Our present rules call for testing of all swine exhibited at a fair if slaughter swine and breeding swine are present at the same show. The animals must have a negative test within 60 days. If the fair chooses to have a split show, in which the breeding swine are exhibited at the first part of the fair, and then sent home, it would be necessary to test only these breeding animals and the slaughter swine can be exhibited and then consigned to slaughter. If however, the choice by the fair is to have a slaughter show only, then no testing would be required--the animals must all go to slaughter.

We have been involved in making a survey--blood samples have been picked up from sows at slaughter plants. Norden Laboratories has been benevolent to the point of testing samples for us. A report on some 600 samples collected at Fort Dodge showed more than 15 percent positive animals. Results on 903 samples picked up at Cherokee and Storm Lake showed a little more than 5 percent positive. Samples have been collected at Cedar Rapids. These samples have not yet been tested.

The Iowa legislature is considering a bill that gives the Iowa Department of Agriculture broad powers. It gives us the authority to promulgate rules that will be in harmony with USDA regulations that may happen in the

future. We also are able to be in harmony with other state regulations. We can establish qualified herds. We can control vaccine.

Our forthcoming rules will be dependent to some extent on the capability of the Veterinary Diagnostic Laboratory to test blood samples. At the present time, they are working to full capacity.

There will be legislation introduced in the Iowa legislature to provide funding either for the establishment of another testing facility in Iowa or for the expansion of testing capability of the Veterinary Diagnostic Laboratory.

Pseudorabies is a reportable disease in Iowa and for the first three months of 1977, we have had 291 cases reported. Forty-two counties have had the disease although the disease has reached epidemic proportions in northwestern and north central parts of the state.

The 291 cases have all been laboratory confirmed. There are others reported that have not been confirmed. It is my feeling that perhaps there are twice as many cases in the state as reported.

When a case is reported, a veterinarian, either State or Federal, visits the farm and an epidemiological report is sent to our office. Many investigations do not reveal a possible cause. The majority of the farms do have possible explanations. Many have purchased swine, usually boars. Dogs, cats, and wild animals are thought to be instrumental in bringing the infection in. Disposals of dead pigs by neighbors is sometimes blamed.

It seems to me that a solution to the problem must mandate the testing of all breeding animals sold.

Approved herds must be established. State and Federal agencies need to cooperate with uniform regulations. We desperately need a program.

RECOMMENDATIONS OF PRACTITIONERS TO PRODUCERS

Paul Doby

The Illinois Department of Agriculture has the following regulations on pseudorabies:

Swine herds will be quarantined if there are deaths or clinical signs of pseudorabies or if the disease is confirmed in the laboratory. Premises are quarantined until 30 days after multiple deaths from pseudorabies have stopped; swine may move only direct to slaughter or slaughter-only markets. Following the release of quarantine, breeding swine may be sold only if they are SN tested and found negative.

There is a voluntary depopulation plan, with state indemnity. All swine exhibited in Illinois (at shows receiving State support) must be negative to a serum-neutralization test for pseudorabies within 30 days prior to the date of exhibition if out-of-state, and 90 days if of Illinois origin.

A bill has been introduced in the Illinois General Assembly to prohibit the production, distribution or sale of any pseudorabies vaccine unless it is licensed by the USDA.

STATE REGULATORY ACTIVITIES ON PSEUDORABIES

L. W. Hinchman

The philosophy of the Indiana State Board of Animal Health, dedicated to the control of disease in the livestock industry of this state has been one designed to accomplish three basic tenets:

1. Identify the disease problem and establish the incidence rate
2. Develop and execute methods of control
3. Eradicate the disease when the incidence rate and available monies are at such levels that will allow the process to be accomplished

Pseudorabies is identified as a current disease problem in Indiana and in many of the major hog producing states in the nation. The incidence rate is based on the occurrence of the disease and positive accessions found in the laboratory. A new regulation will require all swine offered for exhibition have a negative test for pseudorabies within 90 days previous to the exhibition. This time interval is probably too long, but laboratory capabilities make it necessary.

The necessary regulatory procedures in the development of control measures have always required input from regulatory officials and industry. The procedure becomes no less difficult when both regulatory personnel and industry seek to standardize the procedures to the satisfaction of all concerned.

This presentation is offered as a basis for discussion of the areas the Indiana State Board of Health has pursued in the hope to contribute to the national approach to its program of control.

1. Official test - The serum neutralization test will be established as the official test for pseudorabies and its standardization by all State Federal laboratories must be accomplished; however, the potential for future diagnostic procedures must be left open and provide for their recognition in a manner as not to be restrictive to the industry
2. The disease shall be reportable by practicing veterinarians and the laboratory to state regulatory officials
3. The infected herds will be quarantined and their release will be:
    - A. To slaughter
    - B. Testing - the procedure is:
        - (1) Test all breeding stock over six months of age every 30 days; however, no retest will be conducted until the SN positive animals are removed from the premises
        - (2) Release the quarantine after three 30-day negative tests
4. Intrastate and Interstate Sales: the control of all swine movements must be controlled

A. No breeding swine will be sold, bartered or exchanged unless they have a negative pseudorabies test within 30 days previous to sale except:

(1) Swine from approved pseudorabies herds

(2) Swine from a herd having a 20 percent negative pseudorabies test of its seed stock or progeny

(3) Swine sold directly to slaughter

B. No swine will be sold from an infected premise or herd except directly to slaughter

C. Feeder pigs will be quarantined at the feeding premise and sold only to slaughter. Exceptions to be considered after this meeting are:

(1) Feeder pigs from approved herds or from herds having a 20 percent negative pseudorabies test of seed stock or its progeny within 90 days

(2) Vaccinate feeder pigs within seven days of receipt and identify

D. All back-to-the-farm breeding swine sold in auction markets are to be tested in the market, quarantined to consignee pending a negative pseudorabies test for release

4. Approved Herds Protocol

A. Initial 100 percent test of all breeding herd over six months of age with continued monitoring of 20 percent retest every three months

B. Yearly test of 100 percent of eligible breeding swine

C. Any clinical evidence of disease negates approval

5. Vaccination Protocol

A. Restrict the use of the vaccine to veterinarians

B. Vaccine will be permitted only in known infected herds or in herds adjacent to infected herds or in herds in the near vicinity as determined by regulatory officials

C. All sales of vaccine will be reported monthly by the producing manufacturer to state regulatory officials

D. Veterinarians will report the use of vaccine used, indicating the owner, address and number vaccinated, within seven days to state regulatory officials. Failure to report will restrict the further sale and use of the vaccine to the veterinarian

E. All vaccinated swine or swine in contact with vaccinated swine will be quarantined and released for slaughter only, except:

(1) Vaccinated swine may be sold into other vaccinated or infected herds on permit from regulatory officials

F. Identify all vaccinated swine with ½ inch hole punched in the right ear.

This presentation offers controversial projections for discussion, but in the development of all programs of disease control, differences in the approach must be offered as a stimulus for the pursuit of the solution.

Eradication of the disease remains the untimate goal.

PROPOSAL FOR CONTROL AND ERADICATION

J. W. Walker

This presentation will be divided into two parts: the elements of interstate regulations and the components of a plan for a cooperative state-federal pseudorabies eradication program.

Because of the nature of the virus which causes this disease, we believe it will be a long program and an expensive program. There is some risk of failure. Some problems have been discussed in this fact-finding conference and the guidance furnished by these experts will certainly be a part of the plans and decisions as to (1) whether any program should be attempted and (2) what measures are necessary in order to accomplish the goal.

The most important factor is the attitude of the pork-producing industry, in general. Large commercial and purebred producers, who have been either affected by or threatened with pseudorabies, are demanding that some action be taken. No disease of swine today gets more attention in the councils of pork industry leadership; yet attitude surveys of producers and state officials in other parts of the nation reveal some reluctance to accept the restrictions, inconveniences, and, in individual cases, the financial loss an organized action program may bring.

Let me state that my discussion is not a proposal for an eradication program. It is an explanation of what such an eradication program could entail.

Input of the industry is necessary. I would like to encourage each of you to obtain a copy of the proposed interstate regulations.

A 60-day comment period will be allowed. If you have feelings, this will be your opportunity to have a part in the decision. Make your comments specific.

There are parts of the regulation which we feel are open to adjustments. One item I can think of particularly is a requirement that breeding stock moving interstate be tested within 60 days. Most states' import regulations now call for a 30-day test. So there is a likelihood that the proposed Federal regulation will be changed in the interest of uniformity. If the proposed regulation is to be effective, many of the things which some will think unnecessarily restrictive must be included. Otherwise the regulation will have little effect on the spread of pseudorabies between the states.

First of all, the regulation will prohibit the interstate movement of clinically sick animals. Secondly, it will require the testing of all breeding swine over 3 months of age moving interstate, and a herd health certification. Thirdly, it will require that pseudorabies affected (reactor), exposed, or vaccinated pigs move interstate only directly to slaughter and that they be identified by a left ear hole punch. They must be accompanied by a permit; vehicles transporting these animals must be cleaned and disinfected after unloading. The movement of feeder pigs interstate will not be immediately restricted, nor will the movement of slaughter swine be restricted to any great extent.

One of the most important provisions of the proposed regulation is the requirement that one year after the effective date of the regulation neither breeding swine nor feeding swine may move interstate unless they originate in a state which has a reporting and quarantining system for pseudorabies. The most restrictive aspect of that requirement is that an animal which is once affected is considered to be always affected unless some diagnostic efforts are made which will indicate that the infection and exposure has been eliminated.

What can the industry expect of a pseudorabies control and eradication program? Disease eradication programs are designed with the consultation and agreement of affected individuals. Chief among these would be the officials of the state, technical experts, and the members of the industry.

State animal health officials and industry groups are represented in the U.S. Animal Health Association (USAHA). The USAHA committee with the responsibility for pseudorabies is the transmissible diseases of swine committee. This committee meets yearly to make recommendations to the USAHA which, in turn, resolves that its member states and the U.S. Department of Agriculture take certain actions. A detailed disease eradication program would be recommended by the USAHA to the Department. These steps have not yet taken place.

Veterinary Services, APHIS, however, has met with representatives of the swine industry, both commercial and purebred, who were recommended by LCI and NPPC; members of the USAHA; and scientists from various specialty fields of veterinary medicine.

This study group has developed a 3-stage program. The first stage of this program would be preparation to either control or eradicate the disease. This would include dissemination of information on the disease, its control, its eradication, its incidence, its distribution and its cost. Next would be to obtain legislation to authorize funds and personnel for action programs and for indemnification if this is part of the program. Local facilities would be developed to conduct the necessary laboratory work.

During this stage, interstate regulations, uniform methods and rules, and program standards would also be developed. Statistics would be compiled on the prevalence and distribution of the disease. Those states which were ready to enter the control stage may want to consider additional things such as state quarantines, requiring the reporting of the disease, development of regulations on the importation of breeding swine, and testing health certification. Some states have already begun to make these preparations.

The second stage of this action program would be control--in which all breeding swine moving within the state would be required to test within 30 or perhaps 60 days of moving, except those from qualified herds. It would require mandatory reporting of suspected infection and require the application of diagnostic procedures in suspected herds. The state might choose to recognize qualified herds--perhaps requiring a 100-percent qualifying test and retesting at certain intervals. It would quarantine infected and vaccinated premises and require infected and vaccinated swine to have a hole punched in the ear. It would encourage owners to exterminate rats, wild animals, control dogs and cats, permit the movement only directly to slaughter or to qualified feedlots of animals which have been infected or exposed. It would perhaps assist owners of infected herds with voluntary test and slaughter or test and segregation procedures as a way of eliminating the disease and would lend guidance in voluntary depopulation. It would require the prompt and immediate burial or incineration of all animals which died from the disease. It would discourage the introduction of feeder pigs to any premises where breeding operations were conducted and would encourage owners to keep swine separated and housed separately from other species which are also susceptible.

The third stage of the program would be the true eradication stage in which indemnity would be paid. Vaccination would be prohibited. Indemnity would not be paid on vaccinated animals. Importation would be permitted only from stage II or III states. Depopulation would be accomplished as quickly as possible. Tests would be conducted on other domestic species on the premises and reactors to the test would be depopulated without indemnity. In this stage a state would, of course, continue to pursue all stage I and II procedures. I would doubt that any state would enter the eradication stage unless all adjacent states were in at least the control stage of the program.

As in almost all eradication programs, this would be a cooperative venture in which the state and federal governments would, on a 50-50 basis, share the expenses of the program. To say 50-50 is not to ignore the fact that producers in any program of this nature as a group share an equal burden--financially and otherwise. This burden is not distributed equally among them. Some owners bear a great burden--others probably are not financially affected at all.

In the third stage, I mentioned payment of indemnities. I suggest the pork industry should consider taxing itself in a checkoff system to build up a sort of war chest to finance the payment of indemnities. By doing so, the industry would be letting the consuming public know of its willingness to solve its own problem.

And the other thought I want to leave with you is perhaps we haven't done enough to control the interstate movement of feeder swine. Possibly all feeder pigs moving interstate should be subject to at least a screening. This might bring up the standards on feeder pigs to breeder pig level.

COMPARISON OF EMERGENCY AND REGULAR ANIMAL DISEASE ERADICATION PROCEDURES AND RESEARCH NEEDED FOR ERADICATION

J. K. Atwell

Veterinary Services, APHIS, USDA is organized to conduct regular or emergency animal and poultry disease control and eradication programs in cooperation with states. Following is a comparison of both programs:

EMERGENCY	REGULAR
Authority	
Secretary of Agriculture has authority (P.L. 87-518, July 2, 1962) to declare an emergency to combat any disease of animals which in the opinion of the Secretary constitutes an emergency and threatens the livestock or poultry of the United States. State authority is required to control intrastate activities.	Each state operates under basic memorandums of understanding with APHIS, USDA to cooperate in disease eradication programs.
Funding	
On declaration of an emergency Commodity Credit Corporation funds become available for eradication.	Congressional and State legislative action is required for appropriation of funds prior to initiation of program. States share indemnity and support cost in accordance with authorizing legislation.
Priority	
Emergency programs receive priority over other programs for Federal personnel and resources.	State and Federal animal health officials determine program priorities on a state-by-state basis.
Program	
Emergency programs are designed to control and eradicate diseases which constitute a sudden and major threat to the livestock industry such as foot-and-mouth disease, African swine fever, hog cholera, and exotic Newcastle.	Regular programs are designed for eradication of diseases endemic to most of the U.S. which cannot be controlled or eradicated by producers and private veterinarians acting alone such as brucellosis, tuberculosis, scabies, and scrapie.

Duration	
Shorter--more drastic action. Eradication and research conducted concurrently.	Longer--more conservative. Control and eradication methodology developed by researchers and then applied in the field.
Program Direction	
Regional task forces staffed by Federal and State personnel under specific direction of Emergency Programs.	State and Federal animal health officials within the State

B. Criteria for Declaring Animal or Poultry Diseases an Emergency

Declaration of a national emergency to control or eradicate an animal or poultry disease is a decision made by the Secretary of Agriculture. He may receive advice from many people, but ultimately it is his decision. Following are some criteria to assist in making the decision. Perhaps no disease situation would fulfill all these criteria, and some are more important than others.

1. Exotic to the U.S. and recently introduced or endemic disease, but virulence and/or incidence is markedly increasing.

2. Industry supports a rapid response and accepts required restrictions.

3. Legal restriction regarding wildlife, endangered species, environmental protection, etc., do not impose insurmountable obstacles to control and eradication.

4. Humans, pets, and other species that cannot be destroyed do not serve as reservoirs and vectors to the extent control and eradication is not feasible.

5. Economic losses are threatening the industry to the extent price to consumer might be affected.

6. Immediate action and funding is required.

7. Export markets are threatened.

8. Lack of resources to combat the disease through regular State-Federal program.

9. Reasonable assurance that emergency response will reduce losses.

10. The disease poses a public health hazard.

11. Multiple species are affected.

12. Disease is infectious and transmissible and spreading rapidly or has the potential for rapid spread.

13. Technology for eradication is developed or feasible.

14. Manifestations of disease are readily recognizable by producers and practicing veterinarians.

15. Treatment is of minimal value.

16. Control or eradication can be achieved in a short period of time.

17. New or recently introduced pathotype or serotype of etiologic agent is involved.

18. Regular State-Federal programs are not achieving desired results and stronger Federal input with more centralized direction is needed.

C. Research Needed for Pseudorabies Eradication

All eradication programs basically consist of three phases -- stopping spread, reducing incidence, and elimination of reservoirs of the pathogen. Many of the same answers are needed to reduce losses regardless of an eradication program. Eradication research has to be delicately balanced and continually adjusted between field and laboratory. Field research must be supported in the laboratory and laboratory investigators must constantly be aware of the problems in the field.

At least five problems need further work in the laboratory and two in the field.

1. How dangerous are recovered swine? How long and under what conditions are they capable of spreading the disease?

2. Can virus be spread by feeding uncooked pork scraps from incubating, actively infected, or recovered swine slaughtered for human consumption?

3. What is the role of wild and domestic animals other than swine in the epidemiology? How long must a premise stay free of swine to be reasonably sure new swine moving onto the premises will not become infected from other species on the farm?

4. Diagnostic procedures need to be the most sensitive, accurate, rapid, and easily conducted procedures that can be developed. Diagnostic laboratories throughout the United States performing test for pseudorabies must use standardized procedures. The diagnostic procedure should be such that the suspect swine would not have to be killed to determine if infected.

5. What is the best way to destroy infectivity of virus on contaminated premises? How long does virus remain infectious on premises outside of animal? What is the best disinfectant?

6. Can pseudorabies be eradicated from areas where outbreaks are occurring by removing only infected and exposed swine or by other means? Pilot eradication field trials are needed to test alternative approaches.

7. Epidemiological investigations of new cases need to be conducted to determine the source(s) of infection for each new case and assess the relative importance of various means for spread. Specific studies in the field and laboratory may be required to define the epidemiology.

CONTROL AND ERADICATION AT THE LOCAL, STATE AND FEDERAL LEVEL

Questions, Answers, and Discussion

Most of the questions and discussion concerned clarification of Dr. Walker's proposal. The framework for a pseudorabies control and perhaps ultimate eradication program can be derived from the hog cholera program; however, details will have to be filled-in as field and laboratory data on pseudorabies become available.

PROPOSALS AND DISCUSSION FROM AUDIENCE

R. C. Dillman and W. M. Colwell

This research proposal has been funded by the National Pork Producer's Council, Des Moines, Iowa for work commencing June-July, 1977.

Immediate Objectives

1. To determine whether resistance to pseudorabies can be induced in susceptible swine inoculated with heterologous herpesviruses (HHV) and subsequently challenged with virulent pseudorabies virus.

2. To determine the effect of HHV inoculations on serum-virus-neutralization (SVN) titers against pseudorabies before and after challenge with virulent pseudorabies.

3. To determine whether the HHV and pseudorabies replicate and can be re-isolated from swine up to six weeks after challenge with pseudorabies.

Summary of Approach

1. HHV to be initially evaluated are modified live virus (MLV) vaccine strains of (1) Equine Rhinopneumonitis, (2) Infectious Bovine Rhinotracheitis, (3) Infectious Laryngotracheitis (avian), (4) Turkey herpesvirus (Marek's vaccine strain).

2. Weaned pigs 6-8 weeks old from sows serologically negative for pseudorabies antibody and postinoculation serums will be collected at 2 week intervals for the duration of each study and examined for pseudorabies titers by SVN microtiter technique.

3. HHV-inoculations will be by intranasal, intramuscular, and intravenous routes. Each of the three groups will contain appropriate sham inoculated and uninoculated contact controls.

4. The pseudorabies-challenge inoculations will be given two weeks following the HHV-inoculations. The challenge inoculations will be administered intranasally and intramuscularly to all pigs except the contact controls.

5. All surviving animals will be sacrificed six weeks after pseudorabies challenge. All pigs will be submitted to pathologic and microbiologic examinations including attempts to isolate and identify viruses present.

Possible Results

A local tissue immunity with very low or no detectable circulating pseudorabies titers in pigs immune to pseudorabies challenge would be ideal. This would most likely occur in those pigs receiving HHV

via the intranasal route. Realistically, pigs with immunity and/or resistance to pseudorabies challenge will likely have significantly high SVN titers for pseudorabies. This, unfortunately, would tend to invalidate the best current index to pseudorabies exposure under field conditions which is the SVN test. It is very possible that many pigs immune and/or resistant to pseudorabies challenge will harbor virulent pseudorabies as carriers.

Pessimistically, the HHV as selected may not be cross-reactive with pseudorabies and afford no protection whatsoever. In anticipation of such preliminary results, attempts will be made to adapt still other herpesvirus strains to swine. This work will be concurrent with the preliminary investigation described. If suitable funding can be obtained, these further modified herpesviruses could be evaluated in a similar manner as potential vaccines.

PROPOSALS AND DISCUSSION FROM AUDIENCE

Al Keating

The American Farm Bureau Federation is very concerned about the spread of pseudorabies in this country and has been following developments closely.

Delegates from 49 states and Puerto Rico who participated in the 1977 AFBF Annual meeting established a policy position concerning this disease calling for the development and implementation of a control program to halt the spread of pseudorabies in swine and further recommended that a study be conducted to determine the feasibility of an eradication program.

The AFBF Swine Advisory Committee at its February, 1977 meeting made the following recommendation concerning pseudorabies which was approved by the AFBF Board of Directors at its March 7-9, 1977 meeting:

> "The Committee recommends that AFBF initially support stage I of the USDA proposed draft Pseudorabies Eradication Program dated 2/4/77 as a starting point toward a longer range effort specifiec in stages II and III. This initial effort emphasizes information on the disease to the pork industry as an aid to coordinate programs for proposed funding. The results of testing and research should be shared by all states in order to coordinate uniform rules and regulations.
>
> The Committee recommends that any pseudorabies vaccines should be approved by the United States Department of Agriculture."

Farm Bureau believes that immediate actions should be taken to eliminate this disease in the United States before it becomes as widespread and critical as is the case in some European countries.

OUTLINE OF PROPOSED PSEUDORABIES ERADICATION STAGES-USDA-APHIS DRAFT 2/4/77

(A 50/50 STATE-FEDERAL COOPERATIVE EFFORT)

A. Stage I - State and National Organization

1. Disseminate information to producers, practicing veterinarians, and regulatory personnel relative to 1. the disease, 2. its control, 3. its eradication, and 4. its incidence, distribution, and costs.

2. Obtain legislation to authorize funds and personnel for action programs and for indemnification.

3. Develop local facilities and personnel to conduct laboratory tests.

4. Develop Uniform Methods and Rules, interstate regulations, and program standards for States in Stages II and III below:

   a. Voluntary application of State quarantine restrictions.

   b. Initiate interstate movement requirements for swine and voluntary diagnostic procedures on suspect premises.

B. State II - Control

1. Test all breeding swine within 60 days of moving except those from qualified herds - require notification of suspected infection - require diagnostic procedures in suspect herds.

2. Voluntary participation in qualified pseudorabies virus herd program - 100 percent qualifying test.

3. Quarantine infected and vaccinated premises; identify with holepunch.

   a. Exterminate rats, wild animals
   b. Control dogs and cats
   c. Permit movement only directly to slaughter or quarantined feedlots
   d. Voluntary test and slaughter (or segregation) and/or complete depopulation.

C. State III

1. 100 percent Federal indemnity if:

   a. Vaccination prohibited
   b. Indemnity not paid on vaccination
   c. Importation permitted only from State II and III States
   d. All infected and vaccinated herds promptly depopulated
   e. Tests conducted on other domestic species on premises and reactors depopulated without indemnity
   f. All restrictions on Stage II observed
   g. All adjoining States in Stage II and III
   h. State government to supply service, manpower (does not include owner costs) equal to total Federal indemnity

PSEUDORABIES RESOLUTION

National Pork Producers Council

We, the National Pork Producers Council, representing more than 80,000 pork producers from 35 member states that produce over 90 percent of this nations' pork supply, do hereby resolve the following:

* that will cause an assembly to be called of those representing all approved and accountable diagnostic facilities now testing blood samples for this disease, and that they be charged to agree upon and design one standard uniform test analysis procedure based on uniform evaluation, using identical materials and reporting on uniform standards from the results, and....

* that will start immediate action to enhance and to cause a reserve supply of quality anti-serum be produced and approved for interstate shipment that will aid in reducing pig death loss in catostrophic outbreaks of pseudorabies on individual farms, and....

* that will permit interstate movement of only those hogs going direct to slaughter or a slaughter market, or that have tested negative for pseudorabies within the previous 30 days, and....

* that will permit interstate shipment of feeder pigs only from those states where pseudorabies is a reportable and quarantinable disease, and....

* that the NPPC seek immediate audience with U.S. Secretary of Agriculture Bob Bergland, asking that he direct his proper departmental heads to act immediately in implementing actions that will....

* establish an accurate cost-risk-benefit ratio pertaining to this use of vaccines and their effect upon the future control of this disease, and....

* that will develop a total program of positive actions to control the spread and to bring about the eventual erradication of this disease while protecting the economic rights and stability of the individual pork producers and the nuture of this nations' pork industry, and....

* that will cause the USDA budget for fiscal year 1978 to be amended to add supplementary budget item to underwrite those costs of implementing the aforementioned programs for control of pseudorabies in this nation.

INTERIM PROPOSAL FOR CONTROL OF PSEUDORABIES MOVEMENT

William T. Ahlschwede

By Live Pigs

1. Sale Barns--Pigs over 180 lbs. which move through sale barns, terminal markets and collection points are moved directly to slaughter

2. Relaxation of requirements of individual SN tests for interstate movement of breeding stock to free the test capacity for herd testing (sample basis) of breeding stock herds and feeder pig producing herds.

3. Commingled Pigs

a. Breeding stock commingled from several herds are quarantined to the receiving premises and all pigs on the receiving premises quarantined to those premises for 60 days and with appropriate testing.

b. Feeder pigs from commingled sources quarantined to the receiving premises until slaughter as well as are other pigs on the premises.

Movement of Pseudorabies other than through live hogs

Improvement of sanitation and husbandry

1. Disposal of dead pigs and tissues by burial, incineration, or rendering on both infected and non-infected herds.

2. Disposal of other pseudorabies infected dead animals--sheep, cattle, cats, dogs, etc., by burial, incineration, or rendering.

3. Control of movement of other potential carriers of pseudorabies--cats, dogs, wildlife, etc.

PROPOSALS AND DISCUSSIONS

Wayne H. Faber

Our practice is located in Le Mars, Iowa, the county seat of Plymouth county, which is one of the leading counties in pork production in Iowa. Dr. Ronald E. Severson and I practice large animal medicine and have been associated for 22 years.

About 12 years ago, Dr. Severson diagnosed a case of pseudorabies, due to the severe course of the disease, he asked Dr. Weaver, our federal area veterinary, to consult and take tissues to be sure the disease was only pseudorabies. The Iowa diagnostic lab confirmed the diagnoses. This case dealt with suckling pigs from 2 through 8 weeks of age, and a 20 percent death loss was experienced.

Eight years later or four years ago, we again experienced a half dozen cases that were lab-confirmed. Because of the encephalitic symptoms, we asked Dr. Weaver to eliminate hog cholera by tissue examinations in Ames, at the NADC. This case was our first of the current rash of outbreaks and it also was unique in that the producer had "gate cut" 40 sows into two farrowing houses 30 feet apart. Farrowing occurred at the same time in both houses, and iron injections and scour treatments were given in both houses on the same day. All the pigs in one house died with pseudorabies, and none of the few that died in the other house showed any signs of pseudorabies. Two weeks after the last pig died, the dog and three cats died.

We have had premises that have recurrent infections after trying to maintain a closed herd for three to four years between infections. Several clients seem to have continuous outbreaks for several months in various aged pigs that were thought to have been previously exposed.

One client, a pure-bred dealer, felt that the pigs on the one side of his premises away from the farrowing house were not exposed, and that after the quarantine was lifted he would sell boars. Two months later the boars were bled, and all showed high titers. This man did not sell boars as he thought it would be unethical and also legally unsound for a libel standpoint.

In the first outbreaks we found some value in our old hog cholera serum when used on newborn pigs during outbreaks at farrowing time. However, serum procured later did not seem to have as much accidental immunity as the earlier serum.

Observations are that percentagewise the heaviest infection rate is in the most thickly populated areas. This may be a result of the traffic in breeding stock and feeder pigs.

I feel carriers are not always shedders and non-immune animals are not always susceptible. Stress seems important--we had most trouble during the severe cold weather last winter.

The diseases is quite widespread, and because of this we feel an eradication plan would devastate both the commercial producer and destroy purebred and commercial breeding stock people--many 20-50 year veterans with bloodlines and selection involved. We estimate 50 to 80 percent of Plymouth county swine could have titers.

Graduated testing and quarantine programs will take much lab and enforcement personnel. Since we aren't sure of all the methods of transmission or inapparent hosts, we could gain little on a permanent basis.

In the last four years, pseudorabies has mushroomed in our county and into several neighboring counties.

Vaccines should be considered very difinitely and carefully. I have complete respect, confidence, and expectations from our educational and commercial research personnel.

Federal and state regulatory agencies protect us against harmful and useless products, and this is well. I definitely feel that research to identify and eliminate products that would spread the disease should be expedited.

PROPOSALS AND DISCUSSION

Press Release

Within a month, the U.S. Department of Agriculture (USDA) will identify control measures needed in a program on pseudorabies, based on information presented at a two-day fact-finding session held here on this serious disease of swine.

"We will be contacting different groups within the swine industry during this period to get additional input," said Dr. Frank Mulhern, administrator of USDA's Animal and Plant Health Inspection Service (APHIS).

Concern about pseudorabies--a growing threat to the swine industry--was voiced again and again by more than 600 hog producers, veterinarians, state and federal animal health officials, and representatives of other segments of the swine industry attending the April 4-5 conference.

Although the feeling of concern was almost unanimous, there was not agreement on exactly how to deal with the disease.

"The consensus was that the ultimate goal is to get rid of the disease," said Dr. Mulhern, "but we can't get there immediately. What we need right now are ways to stop the spread of the disease and to protect clean herds."

Pseudorabies, also known as Aujeszky's disease or "mad itch" in cattle, may cause death losses of up to 100 percent in pigs less than two weeks old. Swine can transmit pseudorabies to cattle and sheep, where it is almost always fatal. In these species, it produces an encephalomyelitis with signs of severe itching and self mutilation--hence the name "mad itch." As pigs grow older, they develop more resistance to pseudorabies and adult animals may not show signs at all, although some strains of the virus cause severe death losses in grown pigs. Pseudorabies does not affect humans.

The incidence of pseudorabies in swine has increased dramatically in recent years. Laboratory-confirmed cases--an indication of actual incidence--rose from 125 in 1974 to 225 in 1975 and 714 last year. "Reports at the conference indicate we may already have equaled last year's total during the first three months of 1977," Dr. Mulhern said.

Purebred and commercial swine producers from the "hog belt" states of the Midwest detailed how pseudorabies had dramatically affected them. One producer from Illinois related how he had lost about 140 litters per month for four months in his hog-raising operation.

Following are additional points brought out at the conference:

--A safe and effective vaccine is needed to reduce losses and control outbreaks in areas where the disease is a serious problem. Although there is presently no USDA-licensed vaccine, one is under development. It was recommended that any vaccine should be used under strict controls, with its use restricted so that it would not interfere with a long-term goal of eradicating the disease.

--Additional research is needed, but actions to control the disease cannot wait.

--The test for pseudorabies needs to be standardized and additional simpler, quicker and more economical tests should be developed.

--A top priority is determining the actual extent of pseudorabies infection nationwide.

--Movement of swine from diseased herds should be controlled now to protect free herds and areas.

--A proposal was made to have a three-stage program to combat the disease.

Approximately 30 speakers, including scientists from Hungary, Denmark, Canada and Mexico--plus pork producers from a number of states--presented short talks on many aspects of pseudorabies. Extensive question and answer sessions were interspersed among the talks.

PROPOSALS AND DISCUSSION

Daniel Snell

Being hog producers in one of the largest hog producing counties in Indiana and the United States and also one of the areas most highly infected by pseudorabies, we are well aware of the problems involved. Pseudorabies has already had a significant economic effect on many producers. If a workable solution to the problem, is not found as soon as possible, the economic outcome on our area will be disastrous.

Based upon the experience of many of our producers, we would like to recommend the following:

1. An immediate program of vaccination be established at a cost that is not prohibitive to any producer regardless of the size or nature of his operation.

2. That funds be appropriated for further study and development of additional laboratory facilities.

3. That a uniform regulation concerning blood-testing of animals be developed. It should require the testing of animals 30 days previous to a sale and 30 days after the sale following proper shipment and quarantining. This should apply to not only breeding stock but to any and all animals in transit (including feeder pigs). Uniform regulation for state to state transit is necessary for control of this disease. The spread of the disease is such that yearly testing of herds or spot testing is useless.

The degree to which we have been affected by pseudorabies has made it clear that an eradication program is impossible. It is necessary, therefore, that immediate control measures and a vaccination program at a reasonable cost be developed if the hog industry is to survive.

PROPOSALS AND DISCUSSION

R. E. Wright and Carl Ackerman

During the hog cholera eradication program, we had on-the-farm inspection for feeder pigs.

This proved to be an effective disease control program for general swine health in addition to hog cholera. Since this is a good program for swine health and we feel the money is well spent in relation to benefits received, we feel the on-the-farm inspection of pigs consigned to feeder pig sales should be re-instated.

This could be a part of a pseudorabies eradication or a control program.

* * * * * * * * * *

Ron Steffes

As a producer in northwest Iowa, and a producer who has had pseudorabies, I feel we definitely need to standardize the testing procedure. What is a negative animal? We really don't know. Let's begin on the ground floor. We need more research.

We need better facilities to do the proper testing.

We also need the skin test if this test is accurate.

Allow the vaccine to be used if this vaccine has been proven satisfactory.

We need an economical helping hand. Allow the producers to operate and allow seed stock producers that have pseudorabies to sell positive stock to commercial producers.

Let's not discriminate against the producers that have pseudorabies signs.

PROPOSALS AND DISCUSSION

Charles L. Kanitz

Pseudorabies is a highly contagious viral disease affecting many species of warm-blooded animals. Although the disease is thought to be uniformly fatal in all species except swine, it is in the latter species that major economic losses occur as a result of high mortality in young pigs and reproductive failure in sows. A marked increase in incidence and severity of outbreaks in herds throughout the major swine-producing states has occurred since early 1974. Pseudorabies is rapidly becoming a disease of serious economic importance to the pork producing industry in the United States. As such, it is currently the subject of considerable attention from several concerned groups--pork producers, swine practitioners, diagnostic and regulatory personnel and members of the scientific community. A common goal of all of these groups is to find a means of controlling the disease and stopping losses to the industry.

During the last few years, several approaches to dealing with the pseudorabies problem have been suggested by various individuals or groups. These generally fall into one of the following catagories:

1. Ignore the current problem and hope it will run its course and fade away.
2. Control the disease with biologics--antiserum and/or vaccines.
3. Try to stop the spread of the disease through the use of quarantines and other restrictions to swine movements.
4. Attempt to totally eradicate the disease through implementation of a national eradication program.

The first approach can, of course, no longer be considered seriously. The epidemiologic picture that has developed during the last few years shows that the reappearance of virulent pseudorabies virus is not a sporadic occurrence like that seen when the first outbreaks of virulent pseudorabies were reported in 1962 and 1964. Virulent pseudorabies is now known to be widespread and firmly established in areas throughout the middle western and north central states. Losses are increasing each year and have long passed a level where the industry can continue to tolerate them. There is little chance that pseudorabies will naturally revert back to its state of being a benign or inapparent infection in swine--a state that existed in this country for at least 130 years before the first outbreak of clinical disease in newborn pigs was reported in 1943.

The second approach, control with biologics, has considerable merit, but also has some drawbacks. The use of hyperimmune antiserum probably will not play an importnat role in control of the disease. Because of the economics of production, it is unlikely that an adequate supply of high-

quality serum ever will become generally available. To be of any value in lessening death losses in baby pigs, antiserum must be administered prior to infection. Even under controlled conditions, reports of its efficacy vary from good to poor. The temporary protection it may provide is short-lived and easily broken by exposure to high doses of virulent virus. It does not interfere with natural infection or lessen virus shedding.

The one control measure that holds the greatest promise of controlling pseudorabies is the use of a good, attenuated live virus vaccine. Although none is currently licensed for use in the United States, it is hoped that one soon will become available. A single inoculation with this vaccine provides solid protection against challenge with high doses of virulent pseudorabies virus administered parentally, the vaccine virus will not be shed or spread to contact pigs, even under conditions of severe stress. Although the protection provided by the vaccine does not prevent infection of the upper respiratory tract with virulent pseudorabies, it does suppress replication of the virus in these tissues and greatly decreases the amount and duration of virus shedding. Challenge virus is cleared from the nasopharyngeal area of vaccinated swine within 5 days, while similarly exposed nonvaccinates often shed virus until death or for 2 to 3 weeks in survivors. The implementation of a vaccination program would provide direct protection against losses due to pseudorabies and would play a role in controlling the spread of virulent virus by decreasing shedding of the virus from infected swine and lessening opportunities for transmission to feral vectors, domestic animals or other swine.

The third suggested approach to control the spread of pseudorabies, the use of quarantine measures, would be effective only in limiting the spread from endemic areas to areas where the disease is not yet recognized. It would probably not appreciably decrease the spread of infection within, or centrifigally from established endemic areas. Most of the new outbreaks we have seen in these areas are in closed herds with no history of recent additions to the herd. In many of them, however, there has been circumstantial or direct evidence of introduction of the virus by infected feral vectors--raccoons, cats, dogs, or skunks.

To be effective, a quarantine program would have to be absolute--quarantine to slaughter only, all herds in which there is any clinical or serologic evidence of pseudorabies exposed pigs. Since some small fraction of serologically positive swine remain latent carriers of pseudorabies and occasionally shed infective virus, one could not be sure that even a negative animal taken from a reactor herd was free of infection. The quarantine would have to remain in effect during a period of repeated serologic testing and removal of reactor animals, until the entire herd was found to be negative, and remained negative on a subsequent test 30 days later. The numbers of serums that would have to be tested to pursue such a program would far exceed the capacities of diagnostic laboratories now performing the test.

A compromise approach to the quarantine program would be to require a negative test on all animals going to shows or being sold as breeding stock. These should be performed, preferably, within 30 days of time of movement. Furthermore, animals being brought into clean herds should be held in strict isolation for a period of 30 days and retested negative before they are added to the herd. The biggest shortcoming of this program would be the difficulty of trying to implement the same restrictions on feeder pig movements.

The final control measure that was mentioned, and one that presently seems to have a number of proponents, is to implement a national pseudorabies-eradication program. While the concept of total eradication is an idealistic approach to the pseudorabies problem, it should be pointed out that some of the arguments that have been presented in favor of such an endeavor are based on misconceptions.

A serious error is evident in statements to the effect that pseudorabies is still relatively rare in this country or that it has a relatively limited distribution. This is not the case. The disease has been present in the United States since at least as early as 1813 and has been reported in all parts of the country. Many benign infections may go unnoticed. Evidence of this is being found by the detection of antibodies in serums from herds with no history of clinical disease. An effective eradication program would have to include serologic testing of pigs in all parts of the country, including areas where clinical evidence of infection has not been recognized.

Another falacy lies in the optimistic statements that pseudorabies can be eradicated because of the epidemiological characteristics of the disease and because of the recent success in hog cholera eradication. In contrast to hog cholera with its single natural host, pseudorabies is known to be capable of infecting nearly all species of warm-blooded animals. The full role of nonporcine species as vectors and possible reservoirs of the virus is not known. If, in fact, swine are found to be the only reservoirs of the virus, the propensity of pseudorabies to produce benign infections and latent carrier states will still make it very difficult to search out and eliminate all pockets of infection.

It also appears that many outspoken advocates of an eradication program are somwhat misinformed concerning the use of modified live virus pseudorabies vaccines. Statements have been made to the effect that vaccines lack efficacy in preventing the establishment of carrier states; repeated vaccination of all pigs is obligatory; vaccination will not eliminate virulent virus from an endemic herd; and a vaccination program would permit masking of carrier swine. These statements are refutable.

In summary--pseudorabies is currently a serious and growing threat to the economy of the pork producing industry. Positive action must be taken to control the disease. Of the several alternative approaches to control, I believe that the implementation of a national eradication program is unfeasible at this time. A more acceptable approach would include the use of vaccine to stop losses in infected herds and to limit spread and decrease incidence in endemic areas. In addition, a program should be implemented to regulate movement of swine from infected herds in order to prevent the establishment of new foci of infection. First the spread of the disease must be brought under control and the overall incidence of infection identified and reduced by systematically cleaning up infected herds, then more serious consideration could be given to attempting to eradicate the disease in this country.

Reference

Zuffa, A., Grunert, A. and Michalovic, M.: Sanierung einiger Zuchtschweinebestände von der Aujeszkyschen Krankheit. Abl. Vet. Med. 22:89-97, 1975.

PROPOSALS AND DISCUSSION

William Pickart

In cooperation with Dr. John A. Bush, DVM, Flora, Indiana, we have vaccinated approximately 560 pigs with Norden Labs Modified Live Virus Porcine Pseudorabies Vaccine. The first vaccination was made February 13, 1977. Since that time, the vaccinated pigs as well as control pigs with nose to nose contact with the vaccinates have been closely observed. At this date there have been no signs of pseudorabies in these animals. It should be noted that our premises have been contaminated with pseudorabies for some time, and occasionally we experience death loss to the disease, especially in younger pigs. Based on our previous experience, and the observations since starting field trials, we believe this vaccine to be safe and apparently effective. So far, even the control pigs have not shown signs of the disease.

In closing, we would like to state that we strongly advocate the use of vaccine to lower the incidence of this devastating disease. Our area, Carroll County, Indiana, has had widespread outbreaks of pseudorabies. Most of the producers here feel that vaccination is the first step to lessen the great economic loss to the disease. Maybe some time in the future, when the incidence and spread are under control, erradication may be the answer.

PROPOSALS AND DISCUSSION

Questions and answers involving the control and erradication of pseudorabies virus at the local, state and federal levels were as follows:

Question: Why are hogs with titers or those exposed to pseudorabies forbidden to move across state lines while other animals can move?
Animals can move to slaughter. Other than that more technical advice is needed.

Question: How long has Illinois program been in effect?
Slightly fewer incidences seen in 1977, no voluntary depopulation at this time, has not stopped spread.

Question: Seedstock producers favor control but feel the swine movement must be controlled.
Agree by Dr. Walker

Leman reported of survey recently completed by LCI regarding controls of 40 states.

Question: If vaccine is part of control of pseudorabies, how long will use of vaccine be allowed?
Walker = 3-5 years.

Statement was made by Brothers of Texas regarding feeder pig movement within the state.

Question: Mr. Brothers felt that states with low incidence should clean up first.
Dr. Walker felt this division would depend upon momentum created within the state.

Question: Why cannot seedstock from positive herds be sold to other positive herds?
Too much risk involved with movement of known positives.

PROPOSALS AND DISCUSSION

The meeting to this point has discussed the history of pseudorabies in the United States and the programs in other countires. Research underway and the need for additional research in a number of areas has been identified. A number of producers discussed the seriousness of the disease in their herds. The need for a standard diagnostic procedure was again identified.

A proposal for control and ultimate eradication of the disease has been presented by USDA.

The question at this point is do we want to live with the disease or is control and eradication our goal?

First, we must have the commitment of the producer or any program is doomed to failure.

Where do we go from here?

Dr. Butler, State Veterinarian of Iowa, presented the position of the USAHA. Their position was that we must move toward eradication, conduct additional research, and restrict the use of vaccines.

Mr. John Soreholtz, NPPC, presented the eight-point program of that organization, that would work toward eradication.

Dr. Al Leman discussed the position of LCI on pseudorabies. Their position was to conduct a control program working for eradication in phases, with some varying aspects of the program in states with different disease problems and development of qualified herds.

Mr Al Keating discussed the position of the Farm Bureau, which supports the Phase I proposal of USDA, and if a vaccine is to be used in the program, it must be USDA approved.

Suggestions on actions that should be taken were presented by a number of individuals from the floor. This group included producers, practicing veterinarians, researchers, and state and Federal regulatory officials.

Much of the discussion centered around the need to do something quickly to contain the disease and protect non-infected herds, and to assist those producers with the disease. The use of vaccines as an adjutant to control and eradication was stressed by a number of persons from areas where the disease is endemic.

The following points summarize the session:

1. All segments want to control the disease with the ultimate goal being eradication.

2. There is need for additional research, but actions to control the disease cannot wait for all questions to be answered.

3. A need for a standard method of testing for the disease--nationwide--must be developed, recognizing that improved tests may be developed.

4. We need to start now to control movements of diseased animals, to protect free herds and areas.

5. That the Stage I proposal of USDA could be a starting point in a control and eradication program.

6. There is not presently an approved vaccine in the United States, but one is under development. It may be that the use of this vaccine under strict control could be a part of a program.

Dr. F. J. Mulhern indicated that as a result of the input from this meeting that USDA would take a position on pseudorabies within the next four weeks, and that a number of people represented at this meeting might be contacted to assist in the development of that position.

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